Canadian Journal of

PUBLIC HEALTH

VOLUME 41 TORONTO, FEBRUARY, 1950 NUMBER 2

Studies on Poliomyelitis in Ontario*

II. ISOLATION OF THE COXSACKIE VIRUS IN ASSOCIATION WITH POLIOMYELITIS VIRUS: A PRELIMINARY REPORT

CLINICAL OBSERVATIONS

BY

M. PATRICIA ARMSTRONG, M.D.,** F. H. WILSON, M.D., D.P.H., Shelburne, Ont., W. J. McLEAN, M.D., Shelburne, Ont., and NELLES SILVERTHORNE, M.B.**

LABORATORY INVESTIGATIONS

BY

EINA M. CLARK, B.Sc., M.A.,† A. J. RHODES, M.D., F.R.C.P.(EDIN.),† DOROTHY S. KNOWLES, B.A.,† R. C. RITCHIE, M.D.,‡ and W. L. DONOHUE, M.A., M.D.‡

SEVERAL viruses may cause clinical manifestations simulating those of poliomyelitis, and in laboratory diagnosis it is necessary to carry out tests to exclude such infections. In our previous studies on poliomyelitis in Ontario we have investigated the possibility that infections due to the viruses of mumps, equine encephalitis, St. Louis encephalitis, and lymphocytic meningitis may occur (5, 7, 8). The reports of Dalldorf and Sickles (2) and Dalldorf *et al.* (3) indicate that yet another virus has to be considered in the differential diagnosis of poliomyelitis. This virus, tentatively termed "Coxsackie", was first isolated in a village of this name in upstate New York in 1947, and was also

**Aided by a grant from the Health Committee of the Canadian Life Insurance Officers Association.*

***From the Wards and Laboratories of the Hospital for Sick Children, Toronto, and the Department of Pediatrics, University of Toronto, under the direction of Alan Brown, M.D., F.R.C.P.(Lond.).*

†*Connaught Medical Research Laboratories, University of Toronto.*

‡*Department of Pathology, Hospital for Sick Children, and the Department of Pathology, University of Toronto.*

incriminated in 1947 in Ohio, and in 1948 in North Carolina, Texas, Rhode Island and Connecticut by the work of Melnick and his associates (1, 4). This virus characteristically produces a fatal illness in suckling mice on cerebral and peritoneal injection; on histological examination affected animals show myositis, but there are no lesions in the central nervous system. The agent has been isolated from the stools and nasopharyngeal secretions of patients with illnesses simulating non-paralytic poliomyelitis ("aseptic" meningitis), and from cases of transient fever; it can apparently also cause a muscular weakness. The virus has not been shown to be related to any other virus. There seem to be a number of antigenic types.

The report that the Coxsackie virus was isolated in New York State in 1947 is of particular interest to our group, because in the fall of that year we collected stool samples from 20 children studied in hospital in Toronto and diagnosed as suffering from non-paralytic poliomyelitis; from these 20 children, only 4 strains of poliomyelitis virus were recovered (5, 7). At that time we did not know of the observations of Dalldorf. However, in our 1948 field study in Ontario we made tests in suckling mice in 15 cases of clinical poliomyelitis, representing 6 excreting typical poliomyelitis virus in the stool, and 9 others; in no case were manifestations similar to those recorded by Dalldorf and Sickles noted in the sucklings (8).

We have continued our studies of poliomyelitis in Ontario in 1949, and these will be reported fully in due course. The purpose of the present preliminary account is to describe the isolation for the first time in Ontario of the Coxsackie virus from the stools of 4 children, and to mention recovery from the stools of 3 adults. Apart from the fact that we have now established that this infection definitely occurs in Ontario, our observations are of interest because three of the children have been shown also to be excreting typical poliomyelitis virus pathogenic to monkeys. Important questions concerning the relationship of the two infections are therefore raised.

Clinical Observations

This report concerns chiefly a family "J" consisting of father and mother, George (4 years), Brian (2 years), and Douglas (6 months), who reside in a town 200 miles north of Toronto. They were in good health immediately prior to August 11, 1949, when Brian and Douglas both suffered from vomiting and diarrhœa; this was accompanied by fever, and lasted for 2 days. In the light of our previous experience, the illnesses were not considered to be manifestations of poliomyelitis. The mother felt mildly ill on August 15. On August 18, George developed an illness characterized by fever, headache, constipation, nausea, and drowsiness. This lasted for 48 hours, and after a period of well-being for a further 24 hours stiffness of the neck developed and persisted. On August 23, George, although still unwell, was considered sufficiently recovered to drive with the rest of the family to a town in Dufferin County, Ontario, a distance of about 150 miles. On the journey he became worse, was taken at once to a doctor's office on arrival, and was admitted later in the day to hospital with a diagnosis of bulbar poliomyelitis. Paralysis developed in the arms and legs, and he is now left with a weakness of the left

deltoid and shoulder girdle. On August 25, Brian again became sick, this time showing transient irritability and constipation. This was regarded as a probable poliomyelitis minor illness.

From August 23 onward, the members of the "J" family other than George stayed with the "S" family, consisting of father and mother, and a 24-year-old daughter. The two families were subject to quarantine restrictions until August 30, and so the members were in close contact with one another. On September 4 the daughter, Ruby S., developed fever, headache, vomiting, and constipation, being sick for 2 days. A diagnosis of the minor illness variety of poliomyelitis was made.

Another child, Ada O. (aged 6), played with Brian J. in the open air on September 3. On September 12 she became ill with vomiting, fever, headache, stiffness of the neck and back, and soreness and redness of the throat; she recovered in 48 hours. The clinical diagnosis was one of non-paralytic poliomyelitis.

Brief mention will also be made of a 22-month male, Lorny Y., who had no connection with the above and lived elsewhere in Ontario. On July 20 this child developed fever, drowsiness, and a sore throat. On July 23 he was generally weak, had a tremor, and by July 25 he was unable to stand. On July 26 there was marked rigidity, with pain, of the neck and back. On this day the CSF cell count was 35 per cmm., and the total protein 70 mgm per cent. The muscle weakness progressed to frank paralysis and involved the legs and abdomen. On August 6 he could not swallow, but this cleared up after 24 hours. He was admitted to a convalescent hospital where he showed rapid improvement, which began in the legs and worked upwards. By the end of November he was completely recovered. A clinical diagnosis of Guillain-Barré-Landry syndrome was made in view of the clinical history, especially the rapid recovery.

Laboratory Investigations

Collection of Specimens

Stool specimens were collected as follows: Brian and Douglas J. on August 25 and 31; Ada O. on September 14; Lorny Y. on July 27, 28 and 29. Several specimens were collected from Ruby S. and the J. and S. parents, but the results are not yet complete. No specimens were available from George J.

Preparation of Material for Inoculation in Monkeys and Mice

Stools were first prepared as a 10 per cent watery suspension and then centrifuged at approximately 4000 r.p.m. on a horizontal centrifuge, and the deposit saved; the supernatant was then subjected to ultracentrifugation in the "Spinco" centrifuge at a force of 170,000 times gravity (6). Both the deposit and the supernatant resulting from high-speed centrifugation were saved. The deposit of the high-speed centrifugation was rendered bacteria-free by ether treatment and the addition of penicillin and streptomycin. A quantity of 0.8 ml. was then injected into the thalami of a rhesus monkey. The deposit of the low-speed centrifugation was pooled with the supernatant of the high-speed centrifugation, rendered bacteria-free by ether and anti-

TABLE I

RESULTS OF INOCULATION OF MONKEYS AND SUCKLING MICE WITH STOOLS

Patient's Name	Date of Collection of Specimen	Result in Monkeys	Result in Suckling Mice	Conclusions
Brian J.	August 25 and 31 (pooled)	No. 604 developed paralytic poliomyelitis, histologically typical of poliomyelitis.	Three days after inoculation, 2 of 3 survivors were sacrificed. The one examined histologically showed typical changes of Coxsackie infection. One survivor.	Both poliomyelitis and Coxsackie virus present in same pool of stool.
	August 25 (individual specimen)	Test not yet completed.	All 11 mice died or were sacrificed; 2 examined histologically were typical of Coxsackie infection.	
	August 31 (individual specimen)	No. 638 developed paralytic poliomyelitis, histologically typical of poliomyelitis.	All 10 mice died or were sacrificed; 2 examined histologically were typical of Coxsackie infection.	Both poliomyelitis and Coxsackie virus present in individual specimen of stool.
Douglas J.	August 25 and 31 (pooled)	No. 593 had a non-paralytic attack; histology of CNS typical of poliomyelitis.	8/8 mice died or were sacrificed; one was examined histologically, and changes were typical of Coxsackie infection. 7/8 mice of another litter became sick and died; the eighth was examined histologically and changes were typical of Coxsackie infection.	Both poliomyelitis and Coxsackie virus present in same pool of stool.
	August 25 (individual specimen)	No. 639 developed paralytic poliomyelitis; histologically typical of poliomyelitis.	Test not yet completed.	
	August 31 (individual specimen)	Test not yet completed.	7/8 died; the eighth was sacrificed and examined histologically and changes were typical of Coxsackie infection.	
Ada O.	September 14	No. 589 developed paralytic poliomyelitis, histologically typical of poliomyelitis.	10/10 died or were sacrificed; one examined histologically showed typical histological changes of Coxsackie infection.	Both poliomyelitis and Coxsackie virus present in same specimen.
Lorny Y.	July 27, 28 and 29	Test not yet performed.	7/8 died or were sacrificed; one survived. One sacrificed animal examined histologically showed typical histological changes of Coxsackie infection.	

biotics, and was then injected into the peritoneal cavity of the same monkey. By this procedure, the monkey received the fraction containing most of the virus by the most sensitive (cerebral) route; at the same time, any virus present in the other fractions was also inoculated.

Suckling mice aged 2 to 4 days were inoculated cerebrally with a portion of the high-speed deposit, one litter being used per specimen.

To investigate more fully the biological nature of the Coxsackie virus, it was decided to inoculate suckling mice cerebrally with brain and cord from monkeys developing poliomyelitis after inoculation of stool; for this purpose, the monkey nervous tissue was prepared as a 20 per cent suspension. Further, extracts were made of suckling mice showing lesions of the Coxsackie virus by grinding the nervous system, viscera, and muscles and suspending in saline to a final concentration of about 4 per cent. This extract was injected intrathalamically in rhesus monkeys.

Examination of Monkeys

Monkeys were examined closely after inoculation, and were killed after 4 weeks or on the first day of paralysis. Histological examination of the brain and cord was carried out in all animals, and the final diagnosis was based on the histological findings. Some examinations were also made of muscle tissue from the leg and paravertebral regions.

Examination of Suckling Mice

The mice were closely examined after inoculation, and were sacrificed at the first sign of infection, which was usually a definite sluggishness of movement. Exceptionally, infected animals showed paralysis. It was unusual for any considerable number of mice to die after the inoculation of stool extracts except in the presence of the Coxsackie virus. The brain was removed and fixed in formalin, and the remainder of the body was placed in Zenker's fluid.

Results

The results of the examination of the stools of Brian and Douglas J., Ada O. and Lorny Y. are shown in Table I.

It can be seen that, apparently, both the Coxsackie virus and human poliomyelitis virus were present in the pooled stools of August 25 and 31 of both Brian and Douglas J., in the stool of August 31 of Brian J., and in the stool of Ada O. collected on September 14. Additional tests in progress will probably show a similar co-existence of the 2 viruses in the stool of August 25 of Brian J., and in the stools of August 25 and 31 of Douglas J. It will also be seen that the Coxsackie virus has been recovered from the stool of Lorny Y. The results of inoculating a monkey with this specimen are awaited with interest.

Although it seemed probable that in the instances mentioned we were indeed dealing with two distinct agents, it was possible that we had isolated an agent capable of infecting both suckling mice and rhesus monkeys. The results of inoculating brain and cord of 2 poliomyelitis-positive monkeys into suckling mice and of suspensions of 2 Coxsackie-positive mice into monkeys

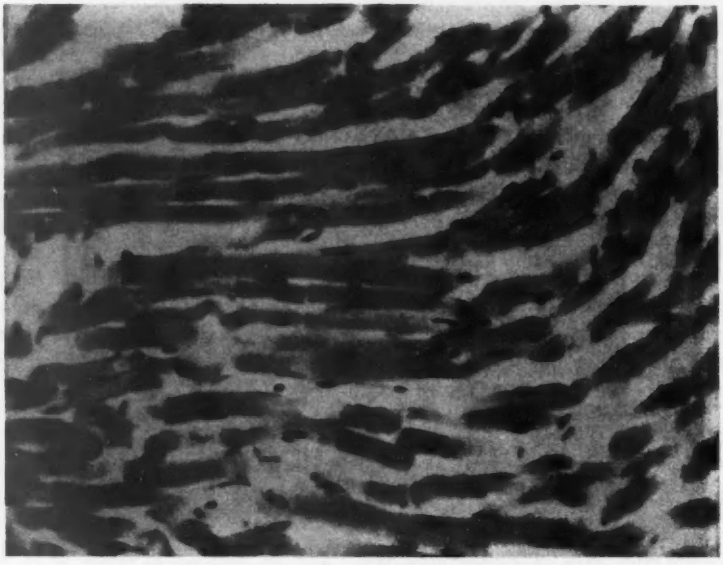


FIGURE I

Normal skeletal muscle of suckling mouse about 6 days old, for comparison with Figure II. Stained haematoxylin and eosin. X 300.

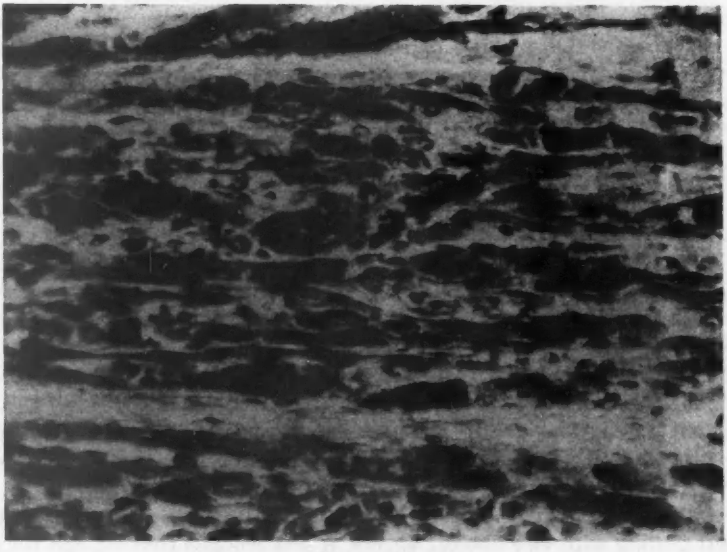


FIGURE II

Skeletal muscle from suckling mouse about 6 days old, previously inoculated with Coxsackie virus. The extreme dissolution of the muscle fibres and the proliferation of the sarcolemma nuclei is evident. X 300.

are shown in Table II. As far as the evidence goes, therefore, we have in fact isolated two distinct agents, the Coxsackie and human poliomyelitis viruses, and not a single one.

It may also be mentioned that the Coxsackie virus has been recovered from the stools of three adults, namely, Mr. and Mrs. J. and Ruby S.; further tests for poliomyelitis virus are in progress.

TABLE II

FURTHER TESTS TO INVESTIGATE NATURE OF COXSACKIE VIRUS

Patient's Name	Source of Inoculum	Animals Inoculated	Result
Douglas J.	Monkey cord No. 593 (positive for poliomyelitis).	Suckling mice	Litter remained healthy.
	Suckling mouse tissue (positive for Coxsackie virus).	Monkey No. 634	No illness and no lesions in muscles or CNS.
Brian J.	Monkey cord No. 604 (positive for poliomyelitis).	Suckling mice	No evidence of Coxsackie infection.
	Suckling mouse tissue (positive for Coxsackie virus).	Monkey No. 633	No illness and no lesions in muscles or CNS.

Passage of Coxsackie Virus

Suspensions of the tissues of suckling mice infected with the Coxsackie virus following the inoculation of the stools of Douglas J. (August 25 and 31 pooled) and Brian J. (August 25 and 31 pooled) were sub-inoculated into further sucklings. Similar clinical and histological appearances were reproduced.

Histological Findings

The histology of the CNS of the monkeys shown in Table I was typical of poliomyelitis; no histological changes were found in the muscles of the leg or paravertebral region of monkeys 604 or 639.

With regard to the suckling mice, as far as could be determined, the brain and cord were free from pathological change except that occasioned by the intracerebral inoculation. The chief lesion, presumably due to the invasion of the virus, was in the skeletal muscle fibres. The changes were characteristic and had resulted in extreme dissolution of the muscle fibres. Many were swollen, hyaline or waxy with complete loss of transverse striation. In some areas the muscle fibres had entirely disappeared. An important feature was a marked proliferation of the cells of the sarcolemma sheath. In places these cells had formed multinucleated syncytial masses with an occasional mitotic figure. Although the muscle tissue was oedematous and obviously undergoing severe retrograde changes, a striking feature was the scarcity of inflammatory exudate. The changes in the skeletal muscles were similar to those

previously described, and to those found in mice inoculated in our laboratory with virus sent by Dr. Dalldorf. No definite changes could be found in the myocardium of the suckling mice.

The histological changes in the affected muscles are shown in the accompanying Figure II, along with the appearances in a normal muscle (Figure I).

Discussion

It would appear that the agent we have recovered from the stools of 4 children and 3 adults resembles in its biological characteristics the Coxsackie virus described by Dalldorf. We have not yet carried out a serological comparison.

It is evident from this study that the Coxsackie virus can become widely disseminated in a family group, in association with the poliomyelitis virus. It appears probable that the three children, Brian J., Douglas J., and Ada O., who had been in close contact with one another, excreted both the Coxsackie virus and human poliomyelitis virus in the same stool specimens. It is difficult to evaluate the pathogenicity of the Coxsackie virus in these children, but consideration of the clinical and epidemiological features makes it appear justifiable to suggest that the mild illnesses of Brian and Douglas J. of August 11 may have been due to this virus. The second illness of Brian J. on August 25 was more probably due to poliomyelitis, as was the illness of Ada O. on September 12.

The recovery of Coxsackie virus from the stool of a child apparently suffering from the Guillain-Barré-Landry syndrome is of the greatest interest, as in the past all attempts at transmission of an infectious agent to animals have proved negative. Nevertheless, until the result of the monkey inoculation is available no conclusion can be reached.

During the past few months we have isolated human poliomyelitis virus from more than a dozen stools obtained from paralyzed Eskimos in Chesterfield Inlet, N.W.T., and from persons sick with clinical poliomyelitis in Dufferin County, Ontario. Only in the 3 cases mentioned in this report have we yet found the two viruses together in a single stool specimen. The association of the two viruses is not therefore universal, and there have been previous reports on failure to find Coxsackie virus in the stools of paralytic cases (1, 4, 8). Melnick however refers to the recovery of both viruses from pooled fæcal specimens (4). It seems highly unlikely that the Coxsackie virus is a latent virus of mice stimulated into activity by the inoculation of poliomyelitis virus or other material, a possibility that has to be borne in mind.

Although certain of the published data, relating particularly to antibody development in convalescence and to the infection of laboratory workers (1, 3), leave little doubt that the Coxsackie virus is pathogenic for man, our results show the need for some caution in assessing the role of this virus. It would seem that before concluding that the Coxsackie virus is the cause of a poliomyelitis-like illness in any given patient, particularly if a paralytic illness occurs in contacts, exhaustive tests must be made for the presence of human poliomyelitis virus in specimens collected within a very short time of the onset

of the illness. No method of preparation of pathological specimens that does not involve centrifugation at high speed can be accepted as adequate.

A final point worthy of mention is the question of whether the two viruses may give rise to any cross-resistance, or whether in the presence of the one virus the growth of the second may be hindered—another example of the interference phenomenon.

The isolation of the Coxsackie virus by Dalldorf represents one of the most interesting and probably one of the most important developments in research into the ætiology, pathogenesis, and epidemiology of poliomyelitis that have been made within recent years. Further developments are eagerly awaited.

Summary

1. An agent with the biological characters of the Coxsackie virus has been recovered from the stools of three children, members of 2 separate households but in close contact with one another. Typical human poliomyelitis virus was recovered from the same specimens of stool. The recovery of the Coxsackie virus from 3 adult members of these households is briefly mentioned.

2. The Coxsackie virus has also been recovered from the stool of a fourth child, suffering from the Guillain-Barré-Landry syndrome, but the monkey inoculation test is not yet complete.

3. It is mentioned that several other stool specimens containing human poliomyelitis virus have failed to yield the Coxsackie virus.

4. These findings demonstrate the need for caution before attributing the ætiology of any given instance of poliomyelitis-like illness to Coxsackie virus.

ACKNOWLEDGMENT

Dr. Gilbert Dalldorf kindly sent us a strain of Coxsackie virus for study.

REFERENCES

1. Curnen, E. C., Shaw, E. W., and Melnick, J. L.: J.A.M.A., 1949, *141*: 894.
2. Dalldorf, G., and Sickles, G. M.: Science, 1948, *108*: 61.
3. Dalldorf, G., Sickles, G. M., Plager, H., and Gifford, R.: J. Exper. Med., 1949, *89*: 567.
4. Melnick, J. L., Shaw, E. W., and Curnen, E. C.: Proc. Soc. Exp. Biol. Med., 1949, *71*: 344.
5. Rhodes, A. J., McClelland, L., and Donohue, W. L.: Canad.M.A.J., 1949, *60*: 359.
6. Rhodes, A. J., and van Rooyen, C. E.: Textbook of Virology. New York: Thomas Nelson & Sons, 1949.
7. Silverthorne, N., Goodfellow, A. M., Anglin, C., Rhodes, A. J., Roy, T. E., and Snelling, C. E.: Canad.M.A.J., 1949, *60*: 356.
8. Silverthorne, N., Armstrong, M. P., Wilson, F. H., Donohue, W. L., Goodfellow, A. M., Roy, T. E., McClelland, L., Clark, E. M., and Rhodes, A. J.: Canad.M.A.J., 1949, *61*: 241.

An Outbreak of Pulmonary Tuberculosis in a Public School

G. M. SMITH, M.D., D.P.H.[1], MAUDE McLELLAN, R.N.[2]
and
J. E. HILTZ, M.D., D.P.H.[3]

THE purpose of this paper is twofold: to report the x-ray findings in school children and their contacts during a routine investigation of the source of infection in a case of tuberculous meningitis; and to show the co-operation of the Nova Scotia Sanatorium, the public health nurse, and the divisional medical health officer.

The investigation took place in the Fundy Division, one of seven health units into which the Province is divided. This unit consists of the fruit-growing Annapolis Valley area. The population, approximately 70,000, is mainly rural, only 18 per cent living in small incorporated towns. The people are mainly of English and Scottish descent, with a few of Scandinavian origin. In the area are approximately 600 Indians of the Micmac tribe and a relatively small Negro population.

The majority of the people are employed in the apple-growing industry, in general farming, and in canneries where seasonal work is available. There is considerable dairy farming on a part-time basis and the Fundy Division supplies a large portion of the milk produced in the Province. Several small industries, including textile plants and granite and gypsum quarries, are in operation.

The Health Unit was organized in 1940 and its staff consists of one medical officer, three nurses, sanitarians, and office staff. For years tuberculosis has been a big problem. Recognizing this, the Unit opened diagnostic chest clinics which are held twice a year in various centres throughout the Division. The original purpose of these clinics was to give a diagnostic service to people living in rural areas and to follow known cases of pulmonary tuberculosis and their contacts. Within a few years, however, tuberculin-test surveys, using the tuberculin patch test, were begun in high schools, with the positive reactors being x-rayed at these clinics. During the past two years this type of service has been extended to the smaller rural schools with one addition: Because of the small numbers of children, all ages have been tuberculin-tested and the positive reactors x-rayed either at the mobile clinic or at the stationary clinic in our Unit Centre.

---

[1]Divisional Medical Health Officer, Fundy Division, Windsor, N.S.
[2]Public Health Nurse, Fundy Division.
[3]Medical Superintendent, Nova Scotia Sanatorium, Kentville, N.S.

Presented before the Epidemiology Section at the thirty-seventh annual meeting of the Canadian Public Health Association, held in the Nova Scotian Hotel, Halifax, June 27-30, 1949.

In addition to this work done by the staff of the Health Unit, similar work is done at the Nova Scotia Sanatorium, which is situated in this Unit, for the residents of the area surrounding it. Thus we have a considerable and continuous program of tuberculosis control in effect throughout the Unit.

Through the years the tuberculosis death rate, all forms, has been considerably lower in this Unit than in the remainder of the Province. The last year for which figures are available, 1947, shows a rate of 27.8 per 100,000 population compared with 49.8 for the Province as a whole.

Likewise, results of the tuberculin patch test surveys show a relatively low incidence of infection, certainly in the high-school groups tested since this Division was opened. The percentage of reactors varied from 8.7 in 1943 to 13.4 in 1946, approximately 1,400 students being surveyed each year. As was stated, this type of survey was extended to children in rural areas and in 1947, 16.6 per cent of 1,300 children were positive reactors, and in 1948 19.6 per cent of 2,500 school children reacted positively. This last figure includes the school under question, where a high percentage of reactors was found. However, there is still an increase in the percentage of positive reactors found as compared with previous years. As yet, I do not know what significance, if any, this increase has or will have. Approximately 90 per cent of the milk consumed in towns is pasteurized, while that in rural areas is largely raw. However, the mainland of this Province is a Restricted Area and we have no reason to believe there is much tuberculous infection among dairy herds. Thus we cannot assume that this increase in the percentage of positive reactors is due to a bovine infection.

During the late winter of 1948 this Department was called to see a nine-year-old boy who was suspected of having tuberculous meningitis. The diagnosis was confirmed and streptomycin was given immediately at the local hospital. Shortly thereafter this patient was transferred to the nearby Nova Scotia Sanatorium, but despite continued streptomycin therapy he died in May, 1948.

In the meantime, following the discovery of this case, our Public Health Nurse had visited and tuberculin-tested the family. All members, including grandparents, parents and four children, were positive reactors and were x-rayed at the Nova Scotia Sanatorium. All were found to have normal chest findings with the exception of the grandfather, age 75 years, and one child, age 5 years. The diagnosis in the former was not definitely established but repeated x-rays and sputum examinations resulted in a diagnosis of no significant disease of the chest. The young child was diagnosed as having active pulmonary tuberculosis, primary infection. Another film taken in one month showed a miliary tuberculosis present and the child was admitted to the Nova Scotia Sanatorium. Streptomycin was given and her parenchymal lesion disappeared with time. However, in November, 1948, she developed tuberculous meningitis and despite further streptomycin therapy died on December 31, 1948.

On learning the results of the x-rays of these contacts, we did not feel that we had found the source of infection and determined to investigate the school by means of the tuberculin patch test and to x-ray the positive reactors.

This school was such as is found in many rural areas of Nova Scotia. It consisted of one room heated by a wood stove, crowded, and with improper toilet and washing facilities. There were thirty-three pupils ranging in age from five to fifteen years, from a surrounding area of approximately three square miles. Of these, 19 or 57.6 per cent were positive to the tuberculin patch test. A part of this group was x-rayed at the Nova Scotia Sanatorium. Three days later, because of the findings, the three remaining positive reactors, all of the negative reactors, and fourteen others—parents, other children and the school teacher—were examined. The findings among the positive reactors in the school were as follows.

X-RAY DIAGNOSIS OF POSITIVE TUBERCULIN REACTORS
RURAL SCHOOL

Number X-rayed	Primary Infection		Pleurisy with Effusion		Pulmonary Tuberculosis, Minimal		No Disease
	Active	Inactive	Active	Inactive	Active	Inactive	
19	7	0	1	0	1	0	10

The fourteen negative reactors all showed negative x-ray films. Of the fourteen others x-rayed, all contacts of the above cases, one mother showed hilar calcification and one mother was diagnosed as having pulmonary tuberculosis, moderately advanced and active. One of her two children in school had an active primary infection. The teacher had a negative x-ray.

Thus, from an investigation to determine the source of infection in a case of tuberculous meningitis, seven children with active primary infection, one child with minimal pulmonary tuberculosis and one child with pleurisy with effusion were found among the school children. Of the contacts x-rayed at that time, one case of moderately advanced, active, pulmonary tuberculosis was discovered. Each of these children's homes was now investigated.

Of the nine children found infected, eight came from six homes—two homes contributing two cases each. These six families lived within a radius of 100 yards of each other; three were related to each other and two others also were related. Moreover, within this same 100-yard radius lived the parents and grandparents of the original case of tuberculous meningitis. They in turn were related to two of the families, one of which contained the adult discovered to have moderately advanced tuberculosis. Our ninth case found in the school lived farther along the same road but except for her going to school had little or no contact with the above-mentioned families.

All of these families were of poor economic circumstances and lived in small houses, which in two instances might be termed "shacks." In these homes of the cases found at school were twenty-two adults and twenty-three children.

These families were followed by repeated x-ray examinations during the summer and fall of 1948. Sputum examinations of the one moderately advanced case found proved to be negative for tubercle bacilli. Difficulty was encountered in having several of the remaining adult contacts examined. However, in December, 1948, the previously negative tuberculin reactors

among the school children were again tuberculin tested, with five of these now reacting positively. It is unnecessary to enter into a discussion as to whether these five were true new reactors or delayed reactors to the tuberculin patch test.

In January, 1949, portable x-ray equipment was taken to this small community and set up in a home. All the school children (negative reactors, old positives, new positives), previously discovered cases, previously examined contacts and further contacts, were examined—a total of 69 persons. Of the five new reactors in the school, one was diagnosed as having active primary infection, and one diagnosis was delayed—this later proved negative. No other new cases were found. The one new case had a brother diagnosed as having pulmonary tuberculosis, minimal stage, and a sister with a primary active tuberculous infection. A considerable number of the new contacts examined were casual contacts only.

By this time we had been able to examine a larger part of the family contacts with the exception of the men. Although repeated opportunities had been presented to them, their pleas were that they could not afford to lose the day's work. Consequently in April, 1949, the portable x-ray equipment was again taken to this area and set up in the evening so that the male members of the families could be examined. At this time eleven further contacts were given their first examination. One parent was found to have pulmonary tuberculosis, moderately advanced stage, active and open—this was proved by sputum examination. A child, age 2½, was found to have a primary active infection—her uncle being the new case of open tuberculosis.

Direct contacts totalled twenty-two adults and twenty-three children. One or more x-rays were obtained from eighteen of the adults and twenty-one of the children. Of the adults who refused to have x-rays, three had been in the Army; one mother was not examined. Two moderately advanced cases, one proven open, were found among the 18 contacts. In the 21 child contacts examined, two primary active infections were found; one was in a child of pre-school age. Thus the investigation of a case of tuberculous meningitis revealed a total of ten primary active cases of tuberculosis, one of which developed tuberculous meningitis. There was one child with pleurisy with effusion; one with pulmonary tuberculosis, minimal stage; and two adults with moderately advanced pulmonary tuberculosis, one of which proved to be an open case. Late in May one parent who had had previously negative chest x-rays was diagnosed as suspect pulmonary tuberculosis.

This open case of tuberculosis lived in a two-room shack with his wife and three children. His wife also had tuberculosis, as had one child. Next door to him on one side was his father, the grandfather of the first case of meningitis, who lived approximately 30 yards away. You will recall also that this boy's sister died of meningitis. On the other side, ten yards away, lived a brother, who was x-ray negative. However, his wife and three of his children were infected. Across the narrow road lived three families who were related to each other, while fifty yards away lived the sixth family. These families contributed all but one of the remaining cases. A small store was operated by one of these families and this store was located directly opposite the home

of our proved open case. While it can never be definitely established, we believe that this man had ample opportunity to infect not only those of his own family but through frequent visiting to the common store and neighbors' homes, those living around him.

An interesting development came to light during this investigation. A young man, on enlistment, was found to have pulmonary tuberculosis. In the course of our investigation we discovered that he was a cousin of our cases of meningitis, and by marriage was related to these families. Moreover, he had lived next door to our open case during the year of 1946-47. In investigating his direct contacts, a further case of primary infection was found in a child of the family in which he made his home.

TABLE I

OUTBREAK OF TUBERCULOSIS
SUMMARY OF ALL CASES

Age in Years	Sex	Diagnosis						
		Meningitis	Miliary	Primary Active	Pleurisy with Effusion	Suspect	Pulmonary Tuberculosis, Minimal	Pulmonary Tuberculosis, Moderately Advanced
9	M	1						
5	F	1 ←	(1) ←	(1)				
9	F				1			
12	F			1				
13	M						1	
9	F			1				
8	F			1				
6	F			1				
8	M			1				
1½	F			1				
6	F			1				
10	F			1				
7	F			1				
28	F							1
32	M							1
28	F					1		
Total		2		9	1	1	1	2

SUMMARY

A case of tuberculous meningitis was discovered in a boy age 9 years. Among his family contacts, a sister was found to have an active primary infection; she eventually developed tuberculous meningitis and died. A

patch-test survey of his schoolmates showed a high percentage (57.6) of positive reactors. These positive reactors, and the school teacher, were x-rayed and nine cases of active pulmonary tuberculosis were found; the teacher had a negative x-ray film. Those who reacted negatively were then given x-ray plate examinations; these were negative for tuberculosis. The contacts of these cases, with the exception of one family, lived in poor homes, greatly overcrowded and in close proximity. There was close blood relationship between two groups of these families. All direct contacts except four adults and two children were x-rayed, with the finding of one suspect case of tuberculosis, two active primary infections and two moderately advanced pulmonary tuberculosis infections. One of these proved to be an open case. This man had ample opportunity to infect the first case of meningitis, his own family, relatives and friends.

Rat Bite Fever

F. A. HUMPHREYS, A. G. CAMPBELL, M. W. DRIVER
AND G. N. HATTON
Laboratory of Hygiene, Western Branch
Department of National Health and Welfare
Kamloops, B.C.

TWO distinct diseases have come to be known as "Rat Bite Fever," the etiological agents of which are entirely unrelated. One is caused by a fungus-like micro-organism variously known as *Actinomyces muris, Streptobacillus moniliformis* and *Streptothrix muris ratti;* the other by a spirillum known as *Spirillum minus, Spirillum morsus muris* and *Spirochaeta morsus muris. Sp. minus* holds a priority in that it was the term applied by Carter in India in 1887 to a spirillum found in the blood of an Indian rat. Both infections are transmitted from rats, usually by the bite of a rat, but also by the bite of a dog, cat or other carnivore, and the symptoms induced by the infections are so much alike a differential diagnosis on clinical grounds alone is almost impossible. This similarity of symptoms has led in the past to a good deal of confusion, for in some cases the spirillae were demonstrated and in others the actinomyces.

In addition to the rodent-borne infections, or those incidental to animal bites, Place, Sutton and Willner (1) reported a milk-borne epidemic at Haverhill, Mass., which clinically resembled the rat bite fevers. The disease became known as Haverhill fever and the causative agent, isolated by Parker and Hudson (2), was given the provisional name of *Haverhillia multiformis.* This organism now is believed to be identical with the rat bite fever organism, *A. muris.*

Although rat bite fevers have been recognized for more than a hundred years—some cases having been reported in the United States as early as 1840—the causative organisms were not discovered until early in the present century.

A. muris was first isolated in 1914 by Schottmueller (3) from a case of rat bite fever in Europe and two years later was recovered by Blake (4) from a fatal case of the disease in the United States. The same year (1916) *Sp. minus* was reported by Futaki and his co-workers (5) to be the cause of rat bite fever in Japan, but it was not until 1924 when Shattuck and Theiler (6) isolated the spirillum from a child in Boston that this organism was shown to be associated with the disease on this continent.

In Japan, where rat bite fever is known under the name of sodoku, the disease has been recognized for many years and the inference is that most of the cases there are due to *Sp. minus.* Reports indicate that about 3 per cent of the rats in that country are infected. Until recently it was believed that most of the

cases in North America were caused by *Sp. minus* but now the consensus is that the greater percentage is due to *A. muris* (7). In Canada the incidence of rat bite fever has been low. Stewart (8) in 1933 in a résumé of the disease in this country reported seven cases—six in Montreal, Que., and one in Nova Scotia—and Cabana (9) in 1940 reported one case also in Montreal. In the available literature no reference has been found to any other cases in Canada.

The purpose of the present communication is to record the observations made in connection with the spirillar type of the infection encountered while conducting rodent surveys for the detection of plague. Most of the infection was discovered while especially attempting to uncover evidence of leptospirosis.

Infections in Laboratory Animals

Natural infections of *Sp. minus* in white mice have been reported by Robertson (10) in England and by Francis (11) in the United States. According to Robertson, Mooser (12) observed a keratitis, conjunctivitis and iritis in rats in the advanced (tertiary) stages of infection and McDermott (13) found post mortem in rats that had died of the disease "gummatoid" lesions in the lungs, lymph glands and occasionally in the liver and spleen. None of these signs of infection were noted in the wild rats examined in this study.

To the guinea pig, *Sp. minus* is definitely pathogenic and induces a chain of symptoms—fever, scrotal swelling and enlargement of the lymphatic glands —that is readily observed. The scrotal swelling, if sufficient time for its development is permitted, is distinct and the enlargement of the inguinal glands is usually readily detected by palpation. As the disease progresses to the chronic stage, the scrotal swelling tends to recede but as this occurs loss of hair in the scrotal region and around the eyes may be noticed. As a rule, the infection is not rapidly fatal to the guinea pig but once established gradually progresses with periodic bouts of fever, unthriftyness, emaciation and eventually death. On necropsy, subcutaneous haemorrhages—not infrequently quite large blotches —are seen. The inguinal glands are slightly swollen; the spleen is enlarged and the vaginal tunics are adherent to the sacs. Examples of typical thermal reactions are shown in Chart I.

The infection is readily passaged in guinea pigs by serial transfer of blood intraperitoneally. Actual demonstration of the causative agent, however, is sometimes difficult. The method found most satisfactory in this laboratory is to take blood (5 - 6 cc.) from the animal by cardiac puncture as soon as fever appears. The blood is citrated and centrifuged until the cells are precipitated; as much as conveniently possible of the clear plasma is drawn off and a loopful of the plasma remaining above the cells is examined by darkfield using either the high power dry or the oil immersion objective. If no spirillae are seen, the clear plasma is re-centrifuged at high speed for 30 or more minutes and the substrate examined. Frequently enormous numbers of spirillae can be demonstrated in the plasma substrate by either darkfield or stained smear.

A. muris is apparently innocuous to the guinea pig and hence is not readily demonstrable in this animal. In the rat the organism has been found as a normal parasite in the nasopharnyx (14) but in the rat, and also in the mouse,

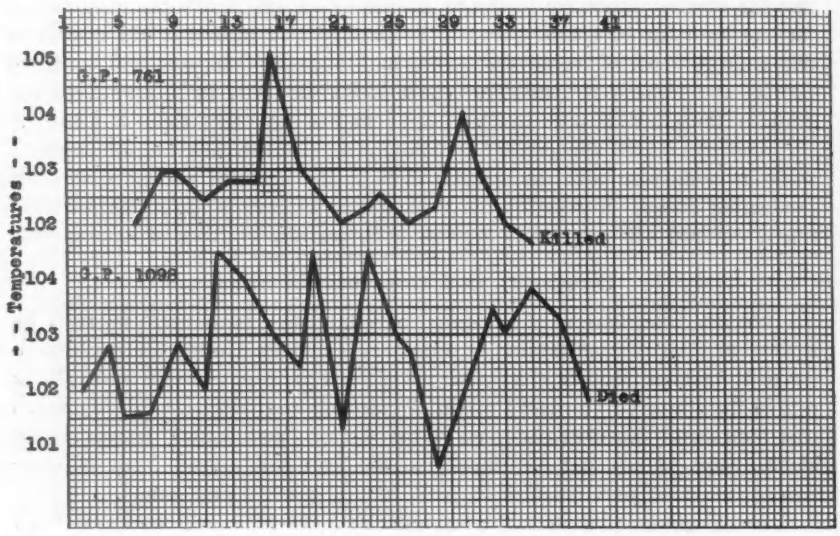


CHART I

SPIRILLUM MINUS—THERMAL REACTION IN GUINEA PIGS

it may assume pathogenicity causing either an acute septicemia or a chronic polyarthritis. No attempt has been made in the present study to isolate this organism.

METHOD OF STUDY

Through the joint action of the Department of National Health and Welfare and the British Columbia Department of Health a continuous survey of rodents is conducted at this laboratory for the detection of rodent-borne infections.

Our interest in rat bite fever was first aroused a few years back when it appeared in a guinea pig exposed to mouse tissue (*Mus musculus*) submitted from near Vancouver.* In retrospect it seems probable that the infection was encountered on other occasions also but because temperatures were not being taken on the test animals it escaped detection. Routinely, temperatures are not taken on guinea pigs exposed to rat tissues but, with a view to detecting the virus of lymphocytic choriomeningitis, are taken on animals injected with mouse tissues. Some guinea pigs exposed to rat tissues and disposed of three to four weeks later, have shown slight glandular involvement which may have been due to *Sp. minus*. During the past year guinea pigs showing any enlargement of the lymph nodes were held for further observation and their temperatures recorded. As a result of this, rat bite fever infection has been uncovered in a number of animals exposed to dead tissues (Table I).

*Organism identified by Mr. Lyndahl E. Hughes, Rocky Mountain Laboratory, Hamilton, Montana.

As a rule, the rodents being examined are killed and dissected by the field crew, and specimen tissues, together with the ectoparasites found on the animals, are submitted to the laboratory in iced containers for bacteriological examination. While this procedure has proved fairly satisfactory for the detection of the Pasteurella infections (plague and tularemia), it seemed highly improbable that it was adequate for determining the presence of diseases caused by the more delicate organisms such as leptospirae. Organisms of this type are short-lived in dead tissues and when shipped from a distance are likely to be innocuous by the time they reach the laboratory. To overcome this it was decided last year to undertake exposure tests with tissues taken immediately after the rodents had been killed. Thus the kidneys of each animal were removed, immediately ground in a mortar and suspended in saline, and 0.5 to 0.7 cc. of the suspension was injected intraperitoneally into each of two young guinea pigs.

TABLE I

Spirillum minus—COMPARATIVE RESULTS OF EXAMINATION OF FRESH AND DEAD RAT TISSUES

	Number of Rats Examined	Kidney Tissues Examined	Number Positive	Percentage Positive	Tissue Pools* Examined	Number Positive	Percentage Positive
Fresh Tissues—(injected immediately after autopsy)	150	150	16**	10.7	84	16**	19.0
Dead Tissues—(injected 24 - 48 hours after autopsy)	947	....	....	....	277	7	2.5

*Includes glands, spleen, liver, and lungs.
** 5 rats, kidneys positive, corresponding tissue pools negative.
5 rats, tissue pools positive, corresponding kidneys negative.
11 rats, kidneys and corresponding tissue pools, both positive.
21 or 14.0 per cent of 150 rats (fresh specimens) positive.

To make immediate injections possible, the guinea pigs at first were shipped to the field station and after receiving the injection were returned to the laboratory. This procedure, although workable, proved cumbersome and was discontinued in favor of capturing the rats in wire traps and shipping them alive to the laboratory.

By these methods 150 rats, taken from various points in the west coast area, were examined. In addition to the immediate injection of kidney suspensions, pooled specimens of glands, spleen, liver and lungs were collected, ground and applied to the scarified skin of another guinea pig as a check for plague infection. Wild rats are readily anaesthetized and as a convenient means of handling them a pledget of cotton dampened with chloroform was placed on the cage and the cage inserted into a paper bag. When the animal was sufficiently anaesthetized, it was removed and a blood sample taken by cardiac puncture for serological test for leptospirosis. The study in connection with leptospirosis is still in progress and will be the subject of another communication.

In order to elicit information on whether *Sp. minus* is eliminated in the urine of infected animals, the urine of each of 21 known infected guinea pigs and 15 Norway rats taken at random was injected intraperitoneally into guinea pigs. The tissues of three of the rats from which urine was taken proved infective. In each instance, from 0.5 to 2 cc. of urine was drawn from the bladder by syringe and passed directly to the test animal. The problem with rats, however, was to obtain sufficient urine. Frequently when the animal came to autopsy the bladder was empty.

Results and Discussion

Of 150 rats from which fresh tissues were examined, 21 (14.0 per cent) were found infected with *Sp. minus*. The infection was recovered from both the kidneys and the tissue pools (glands, spleen, liver, lungs) of eleven rats, from the kidneys alone of five and from the tissue pools only of five.

By contrast, of 269 dead tissue pools (not including kidneys) removed from 920 rats taken in the same areas and during the same period for examination for plague, only six (2.2 per cent) proved positive for *Sp. minus*. The spirillum was recovered also from one of eight dead tissue pools taken from 27 rats collected on Oriental ships after fumigation.

TABLE II

Spirillum minus—Infection by Areas

Source of Specimens	Fresh Tissues			Dead Tissues		
	Number of Rats Examined	Number of Rats Positive	Percentage of Rats Positive	Number of Pools Examined	Number of Pools Positive	Percentage of Pools Positive
Vancouver Area (20-mile radius)	74	20	27.0	170 (617 rats)	5	2.9
Fraser Valley	35	1	2.8	69 (209 rats)	....	....
Vancouver Island	41	....	....	30 (94 rats)	1*	3.3
Ships (rats collected after fumigation)	....	....	....	8 (27 rats)	1	12.5
Total	150	21	14.0	277 (947 rats)	7	2.5

*Taken at Port Alberni garbage dump.

The findings indicate clearly that the examination of fresh tissues is essential if an accurate indication of the incidence of infection is to be obtained; also that both kidneys and other body tissues should be examined.

As shown in Table II, the incidence of infection is high (27.0 per cent) in the area immediately adjacent to Vancouver, but relatively low in the other areas. Whether this is explainable on the grounds that the Vancouver area has greater contact with Oriental shipping is doubtful. However, the finding points to the need of continued vigilance regarding rat-borne infection.

Sp. minus was recovered from the urine of three of 21 infected guinea pigs and from one of three infected Norway rats by injecting the urine intraperitoneally into guinea pigs. The number of infected rats examined in this instance is too small to be considered significant but even with this small number the demonstration that the spirillum is recoverable from the urine suggests that rat-defiled food stuffs and other materials might be a source of human infections.

REFERENCES

1. Place, E. H., Sutton, L. E., and Willner, O.: Boston Med. & Surg. J., 1926, *194*: 285.
2. Parker, F. and Hudson, N. P.: Am. J. Path., 1926, *2*: 357.
3. Schottmueller, H.: Derm. Wschr., 1914, *58*: suppl., p. 77.
4. Blake, F. G.: J. Exp. Med., 1916, *23*: 39.
5. Futaki, K., Takaki, J., Taniguchi, T. and Osumi, S.: J. Exp. Med., 1916, *23*: 249.
6. Shattuck, G. C. and Theiler, M.: Am. J. Trop. Med., 1924, *4*: 453.
7. Editorial comment: Canad. M. A. J., 1945, *53*: 591.
8. Stewart, R. C.: Canad. M. A. J., 1933, *28*: 608 and 656.
9. Cabana, J. E.: Canad. M. A. J., 1940, *43*: 65.
10. Robertson, A.: Ann. Trop. Med. & Parasit., 1930, *24*: 367.
11. Francis, E.: U.S. Pub. Health Rep., 1936, *51*: 976.
12. Mooser, H.: J. Exp. Med., 1924, *39*: 589.
13. McDermott, E. N.: Quart. J. Med., 1928, *21*: 433.
14. Strangeways, W. I.: J. Path. & Bact., 1933, *37*: 45.

A New and Practical B.C.G. Skin Test (The B.C.G. Scarification Test) for the Detection of the Total Tuberculous Allergy

ARMAND FRAPPIER AND ROLAND GUY
Institute of Microbiology and Hygiene and the School of Hygiene
University of Montreal
Montreal, Quebec

A TRUE or modified Koch's phenomenon can be reproduced in animals with B.C.G. vaccine (Boquet and Nègre) (1). Observations bearing upon the local cutaneous effects of B.C.G. in tuberculous patients have been made, from a descriptive point of view, by authors chiefly concerned with using B.C.G. for the treatment of tuberculosis: Gomez (2), Radossavliévitch *et al.* (3), Coulaud (4), Coulaud and Lescuyer (5), Coulaud (6), Corre (7), Gernez-Rieux *et al.* (8), Arnaud and Chevalier (9).

That the characteristics of such local reactions to B.C.G. could present some value as a most sensitive test for the detection of tuberculous allergy has been suspected by Carlinfanti (10), Chaussinand (11, 12, 13) and Thorkildsen (14).

Since the work of Romer (15) and Calmette and Guérin (16), it has been known that the absence of reaction to strong doses of tuberculin does not always correspond to a negative state of hypersensitivity to all tuberculous products. The dissociation of sensitivity to tuberculin and to bacterial bodies or proteins has been later studied:

(*a*) In tuberculin-desensitized subjects, in which most authors agree (Thomassen, 17) that sensitivity to the parenteral introduction of bacillary bodies is not wholly abolished. (It would also be interesting to investigate the response to bacillary products, other than tuberculin, in tuberculous individuals showing temporary tuberculin desensitization induced by certain pathologic or physiologic conditions, or in tuberculous animals or patients in the terminal and tuberculin anergy phase of their disease.)

(*b*) In other healthy humans who, although negative to a strong dose of tuberculin, still reveal specific hypersensitivity, as shown by their capacity to present an accelerated local reaction to the parenteral introduction of tuberculous bacillary bodies (such as B.C.G.) and, in most instances, the Baldwin-Gardner-Willis phenomenon (18, 19), also called the Willis-Sayé phenomenon (20), when induced in B.C.G. vaccinated subjects. This phenomenon consists of an earlier, more intense response to tuberculin, following reinfection,

Presented before the First International Congress on B.C.G., Paris, June 1948. This work has been partly supported by a grant-in-aid from the National Research Council of Canada.

in subjects whose reactivity to tuberculin has spontaneously faded or disappeared. The state of partial hypersensitivity found in these healthy individuals has been called "infratuberculin allergy" (21) or "allergie résiduelle" (22) or "allergie déclinante" (24), or "secondary allergy" (23).

The accelerated reaction to B.C.G. and the connection between allergy to tuberculin and allergy to B.C.G. in *B.C.G. vaccinated human individuals* have been the subject of studies by Brinchmann (25), Solem (26), Rinvik (27), Civeira and Urioste (28), and Thomassen (17), although, since 1942, Assis (29) has actually used *intradermal* inoculation of killed B.C.G. as a routine diagnostic test in order to detect infratuberculin allergy. Bueno (30) mentions that, in Brazil, it is systematically sought in all individuals, except the newborn, negative up to 10 mg. of tuberculin. An intracutaneous injection of 1/10 mg. of *killed B.C.G. vaccine* is then given. A positive reaction consists

TABLE I

INCIDENCE OF THE INFRATUBERCULIN ALLERGY IN DIFFERENT COUNTRIES
(B.C.G. intradermal and transcutaneous tests)

Authors	Number of Subjects Negative to Tuberculin (children and adults)	Infratuberculin Allergy	
		Number Positive	Incidence %
J. Rosemberg (B.C.G. intradermal test) 1946	377	104	27.6
O. M. Andenoes (B.C.G. multiple puncture test) 1945	111	19	17.1
A. Frappier and R. Guy (B.C.G. scarification test) 1948	626	143	22.9

of a premature and local reaction. In such cases, the Willis phenomenon can also be demonstrated in the first week following this B.C.G. inoculation. Assis found infratuberculin allergy to be present in *76.2 per cent of persons once vaccinated with B.C.G.*, the incidence being much lower in non-vaccinated subjects negative to the Mantoux test. In group surveys, Rosemberg (31) (Table I) reports an incidence of 27.6 per cent of infratuberculin allergy, in *non-vaccinated individuals negative to a Mantoux test*, made with 1/10 dilution of tuberculin, and emphasizes the high accuracy of the B.C.G. intracutaneous test. Andenoes (32) (Table I), in a smaller survey, had reported an incidence of 17.1 per cent (multiple-puncture test).

Recently, Chaussinand (24) confirmed the use of *an intradermal test* with a dilution of killed B.C.G. vaccine for the detection of total allergy, especially in B.C.G. vaccinated subjects. Strong reactions may ulcerate and heal with scar formation. Uvstedt and Aanonsen (33) have proposed a "B.C.G. diagnostic test" performed by *the puncture method*, using a special instrument capable of making two pricks in the skin through a drop containing 20 mg. of B.C.G. per ml.

During our own investigations on the receptivity of adults to B.C.G. vaccine, at a concentration of 60 mg. per c.c. and introduced by the multiple-puncture and the scarification methods, we met with an appreciable incidence of infratuberculin allergy, as detected by accelerated local reactions to B.C.G. in subjects negative to 0.005 mg. of P.P.D. (Purified Protein Derivative). We thought that a *single scarification* through a drop of a *live emulsion of B.C.G.* at an optimum concentration would constitute a most sensitive test for thorough detection of tuberculous infection, especially when B.C.G. vaccination is contemplated. It could perhaps be substituted, in such instances, for the time-consuming and unpleasant serial tuberculin tests.

The present paper reports comparative results obtained in subjects, children and adults, tested with progressive doses of tuberculin and with scarifications through drops of B.C.G. at various concentrations. Our purpose was to determine the optimum concentration of B.C.G. introduced by one single cutaneous scratch, which, by the acceleration of the local reaction, would reveal the slightest specific hypersensitivity, detecting infratuberculin allergy but still *not capable of inducing too severe a local reaction*, nor any focal or general response.

Methods and Clinical Material

(*a*) *Tuberculin Tests*

In most groups, tuberculin tests were done first with a Vollmer Patch Test, put on the upper back, between the inferior angle of the scapula and the spinal column. In subjects negative to this percutaneous test, an intradermal injection of P.P.D., 0.005 mg., was made in the anterior forearm. Only fresh dilutions of P.P.D. were used.

The reactions to the Vollmer Patch Test were read and recorded according to the following standards:

O: no detectable reactions on both tuberculin squares.

+: a few distinctive papules on one or both of the tuberculin squares.

++: raised induration covering the whole area of one or both of the tuberculin squares.

+++: induration trespassing on the areas of one or both of the tuberculin squares.

++++: vesiculation or necrosis present on one or both of the tuberculin squares.

Readings were made 48 hours after removal of the patch.

For the Mantoux test, the intensity was graduated according to the recommended standards of reading. Reactions of less than 5 mm. were considered as negative.

(*b*) *B.C.G. Scarification Test*

The technique of the B.C.G. scarification test resembles that of the Von Pirquet tuberculin test. An ordinary sterile needle is used.

The site of the test was always the lower lumbar region. One control scratch of one cm. in length is made on one side of the vertebral column and

a similar scratch through a drop of the B.C.G. special emulsion on the opposite side. Both scratches can also be made on the upper arm and a few centimeters apart.

When making the scratch, sufficient pressure is applied in order to draw a slightly blood-tinged serous exudate within a few seconds. Not more than a single scratch is made through the drop of B.C.G. emulsion so as to avoid an unnecessary size of reaction or to prevent overlapping of reactions when using several drops of B.C.G. at different concentrations. With the needle, held tangentially to the skin, the serous exudate is diluted with the B.C.G. All scratches are covered with a sterile dressing left in place from 12 to 24 hours. The local reactions were observed 24, 48, 72 and 96 hours after the scarification test. In some instances, rectal temperature was recorded immediately before the B.C.G. test and at 24 and 48 hours after the test. In other groups, rectal temperature was checked only in individuals showing intense local and general reactions.

Identification of Groups

In Table II are numbered and described the groups of subjects, of different ages and sexes, selected from scattered geographical areas, who were B.C.G.-tested. These subjects were first classified according to their *state of hypersensitivity to tuberculin:* those positive to the Vollmer Patch Test compose the category of "STRONG ALLERGY"; those negative to the Vollmer Patch Test but positive to strong P.P.D., 0.005 mg., are included in the "WEAK ALLERGY" category; the remaining subjects are negative to tuberculin.

These individuals were then given the B.C.G. scarification test with varying concentrations of vaccine: 60, 25, 10, 5, 1 or 1/10 mg. per c.c. Some groups received only one concentration of B.C.G., others two or more at one

TABLE II
IDENTIFICATION OF GROUPS

Groups	Locality	Ages (years)	Sexes	Number of Subjects B.C.G.-Tested
1	Sedentary Indians—Oka	all	both	118
2	Mental institution—Montreal	5 to 70	both	265
3	Public school—village in vicinity of Montreal	5 to 15	both	127
4	Public school—village in vicinity of Montreal	5 to 15	both	97
5	Mental institution—Montreal	6 to 50	both	33
6	Mental institution—Montreal	5 to 15	girls	22
7	Mental institution—Montreal	5 to 15	girls	19
8	Sedentary Indians—Caughnawaga	5 to 15	both	257
9	Nomad Indians—Abitibi-East	all	both	24
TOTAL, 9 GROUPS	—	—	—	962

time. In the category "STRONG ALLERGY" only a limited number of individuals from a few groups were B.C.G.-tested because of the obvious possibility of severe local reactions to B.C.G.

According to their response both to tuberculin and B.C.G. bacillary proteins, the individuals composing the different groups studied are then finally classified in the following categories:

(*a*) "NO ALLERGY": those showing no reaction to all tuberculin tests and no accelerated reaction to B.C.G.

(*b*) "INFRATUBERCULIN ALLERGY": those completely negative to all tuberculin tests but positive to B.C.G.

(*c*) "WEAK ALLERGY": those negative to the Vollmer Patch Test but positive to strong P.P.D., 0.005 mg.

(*d*) "STRONG ALLERGY": those positive to the Vollmer Patch Test.

RESULTS

1. *Local Reaction to B.C.G. Scarification Test*

In a negative B.C.G. scarification test ("NO ALLERGY" category), within 48 to 72 hours, both scarifications, B.C.G. and control, are reduced to simple lines or mere traces. During that period, the evolution of the inflammatory reaction of the control scarification, in all subjects, is similar to that of the B.C.G. scarification in subjects of the "NO ALLERGY" category, as described in Table VI. However, it is to be remembered that the *normal local reaction* to B.C.G. in such subjects of the "NO ALLERGY" category would develop after 10 or 12 days from the time of the B.C.G. inoculation.

Any reaction, on the site of the B.C.G. scratch, persisting over 72 hours, when the inflammatory reaction to the control scratch has disappeared, is considered specific.

For practical purposes, an earlier, but presumptive positive reaction, may be ascertained at 24 or 48 hours, in strongly positive individuals, when the reaction to the B.C.G. scratch is obviously more important than the reaction to the control scratch. The diameter of the latter rarely reaches 1.5 mm., and usually varies between 0.5 and 1 mm.; in exceptional cases it may reach 2 mm. In this connection, reactions to the B.C.G. scratch showing more than 2 mm. in diameter at 24 or 48 hours were in all cases still positive at 72 and 96 hours, when the control reaction had disappeared by that time.

The following main characteristics are observed in a typically positive B.C.G. scarification test, as early as from the first 24 hours (this applies to "STRONG", "WEAK" and "INFRATUBERCULIN ALLERGY" categories):

1. Enlargement of the scarification by œdema with intense redness. This inflammatory reaction is more important, more visible, palpable and of a different shade than that of the control scarification and persists, as said above, for over 72 hours, whenever the reaction to the latter is merely visible at 72 hours.

2. The presence of pus is noted, especially in the more sensitive individuals

(Tables IV and V), but unwanted scar formation will occur mostly in those tested with a concentration of B.C.G. higher than 25 mg. per c.c.

3. From the first 48 hours, the intensity of the local specific symptoms, as measured by the diameter of redness and œdema, diminishes from day to day. In concentrations of 10 mg. of B.C.G. per c.c. or less, the specific inflammatory process, as a rule, has subsided within a week.

2. *Demonstration of infratuberculin allergy in B.C.G. scarified individuals*

A. *Incidence of infratuberculin allergy as shown by accelerated local reactions to B.C.G. in subjects completely negative to intradermal P.P.D., 0.005 mg.*

The incidence of infratuberculin allergy in the total number of B.C.G.-tested subjects is 22.9 per cent (Table I) and is comparable to the figures of Rosemberg and Andenoes, previously mentioned, who used intradermal or multiple-puncture B.C.G. tests.

TABLE III

CLINICAL DEMONSTRATION OF THE BALDWIN-GARDNER-WILLIS-SAYE PHENOMENON AFTER VACCINATION WITH B.C.G. CONCENTRATED TO 60 MG. PER C.C. AND INTRODUCED BY THE TRANSCUTANEOUS METHODS

Categories	Total Number B.C.G.-Tested and *Tuberculin-Retested 12 Days Later*	Mantoux P.P.D. 0.005 mg.									
		Total Number of Positives		Intensity of Reactions							
				+		++		+++		++++	
		Number	Per cent	N.	%	N.	%	N.	%	N.	%
"WEAK ALLERGY"	66	66	*100*	0	*0*	21	*32*	38	*58*	7	*10*
"INFRA-TUBERCULIN ALLERGY"	27	27	*100*	0	*0*	8	*30*	12	*44*	7	*26*
"NO ALLERGY"	96	64	*67*	15	*23*	44	*69*	5	*8*	0	*0*

B. *Incidence of infratuberculin allergy as shown by the Willis phenomenon in subjects completely negative to tuberculin.*

One hundred and eighty-nine subjects of Group 2 (Table II) were selected for the clinical demonstration of this phenomenon. Of these, 123 had been found negative to all tuberculin tests as previously described and 66 were of the "WEAK ALLERGY" category (negative to the Vollmer Patch Test but positive to P.P.D., 0.005 mg.). All subjects were immediately vaccinated with B.C.G. using the transcutaneous methods.

According to the type of the cutaneous response to vaccination with B.C.G., observed 96 hours later, the *123 tuberculin-negative subjects* are divided into two categories:

1. "NO ALLERGY" category: 96 individuals *not presenting the phenomenon of accelerated local reaction*, characteristic of infratuberculin allergy.

2. "INFRATUBERCULIN ALLERGY" category: 27 subjects *presenting local accelerated reactions to B.C.G.*

Twelve days after the vaccination, all 189 subjects were Mantoux-tested with P.P.D., 0.005 mg.

At that time, the state of hypersensitivity to tuberculin, as shown in Table III, both by the percentages of positive reactors and the shifting of the intensity of reactions, is much more accentuated in the "WEAK ALLERGY" and "INFRATUBERCULIN ALLERGY" categories than in that called "No ALLERGY": that is, for the Mantoux test, 100 per cent and 100 per cent, respectively, against 67 per cent, for positivity; and 10 per cent and 26 per cent of 4 + reactions against 0 per cent, for intensity.

TABLE IV

B.C.G. SCARIFICATION TEST
in the "STRONG ALLERGY" category
(Vollmer Positives)

Concentration of B.C.G. in mg./c.c.	Reading Time in Hours	Number of Subjects	Mean Measure in mm.	Maximum Measure in mm.	Minimum Measure in mm.	Percentage of Purulent Reactions
60	24	24	12	20	2	—
	48	20	15	35	2	80
	96	22	8.5	15	4	36
25	24	24	10	15	2	—
	48	20	12	35	2	75
	96	19	3.5	9.5	1	11
10	24	25	5.2	12	1.5	36
	48	25	4.4	10	1.5	36
	72	25	2.8	5	2	4
	96	25	2.5	4	1.5	0
5	24	47	4.2	17	1	38
	48	47	4.4	15	1	40
	72	47	2.4	4	1	4
	96	47	2.4	4	1	0
1	24	36	2.6	9	0.5	—
	48	36	2.5	6	0.5	19
	72	36	1.8	4	0.5	5
	96	36	1.5	3	0.5	0
0.1	24	36	1.2	2	0.5	0
	48	36	1.5	2	0.5	0
	72	36	1	2	?	0
	96	36	1	2	?	0

3. *Tentative determination of the optimum concentration of live B.C.G. per c.c. and time of reading of reactions for the B.C.G. scarification test*

The results (Tables IV, V, VI) show that, in allergic subjects, be they Vollmer, Mantoux or infratuberculin allergic, the mean intensity of the local accelerated reactions to live B.C.G. vaccine is a function of the concentration of the bacterial emulsion. In those positive to tuberculin, it is proportional to the sensitivity of the individuals to tuberculin, as pointed out by Carlinfanti (10) and Thomassen (17). Furthermore, the presence and persistence of pus in strongly hypersensitive individuals and the persistence of peripheral redness seem also directly related to the concentration of the B.C.G. emulsion. No difference is seen between children and adults, white or Indian.

With 60 mg. of B.C.G. per c.c. of emulsion, in groups composed of Vollmer-

TABLE V

B.C.G. Scarification Test
in the "WEAK ALLERGY" category
(P.P.D. 0.005 mg. Positives)

Concentration of B.C.G. in mg./c.c.	Reading Time in Hours	Number of Subjects	Mean Measure in mm.	Maximum Measure in mm.	Minimum Measure in mm.	Percentage of Purulent Reactions
25	24	23	1.9	10	0.5	9
	48	23	1.6	8	0.5	—
	96	23	1.3	3	0.5	0
10	24	56	1.8	4	0.5	8
	48	56	1.4	3.5	0.5	8
	72	13	1.5	2	1	0
	96	23	1	2	0.5	0
5	24	17	1.7	3	0.5	6
	48	17	2.2	3.5	0.5	12
	72	17	1.7	2.7	0.6	0
	96	4	1.2	2.7	0.5	0
1	24	4	1.3	1.5	1	0
	48	4	1.8	2	1	0
	72	4	1.4	2.5	1	0
	96	4	1.4	2.5	1	0
0.1	24	4	1	1	0.5	0
	48	4	1	1.5	0.5	0
	72	4	1	2	0.5	0
	96	4	1	2	0.5	0

allergic individuals, i.e. of the "STRONG ALLERGY" category (Table IV), the reactions are too severe for practical use. The disadvantages of such a concentration would be: (1) too severe local reactions with a tendency to slower drying and healing, and regular formation of a scar; (2) the occasional possibility, as reported by Coulaud (4, 5, 6) and Gernez-Rieux (8) and observed by

TABLE VI

B.C.G. SCARIFICATION TEST
in the "INFRATUBERCULIN ALLERGY" and "NO ALLERGY" categories

Concentration of B.C.G. mg./c.c.	Reading time hours	Number of subjects per category		Reactions mean diam. mm.		Reactions max. diam. mm.		Reactions min. diam. mm.		Percentage suppuration	
		Infra all.	no all.	Infra all.	no all.	Infra all.	no all.	Infra all.	no all.	Infra all.	no all.
60	24	43	155	6.0	1.5	12.0	1.5	1.5	0.5	40	0
	48	43	155	5.0	0.5	10.0	0.5	1.5	0	40	0
	72	43	155	5.0	0	9.5	0	1.0	0	40	0
	96	43	155	4.0	0	8.8	0	1.0	0	40	0
25	24	50	184	3.0	1.0	6.0	1.5	1.5	0.5	0	0
	48	50	184	2.0	0.5	4.0	0.5	1.5	0	0	0
	72	50	184	1.5	0	2.0	0	1.0	0	0	0
	96	50	184	1.5	0	1.5	0	1.0	0	0	0
10	24	99	322	2.0	1.0	5.0	2.0	1.0	0.5	0	0
	48	92	322	1.6	0.5	3.0	1.0	1.0	0	0	0
	72	23	66	1.3	0	2.0	0	1.0	0	0	0
	96	39	195	1.0	0	2.0	0	1.0	0	0	0
5	24	24	72	1.5	0.7	4.0	1.0	1.0	0.5	0	0
	48	24	72	1.0	0.5	2.0	0.5	1.0	0	0	0
	72	24	72	1.2	0	2.0	0	1.0	0	0	0
	96	24	72	1.0	0	1.5	0	1.0	0	0	0
1	24	11	90	1.3	0.7	2.0	2.0	0.5	0.5	0	0
	48	11	90	1.5	0.5	2.0	1.0	0.5	0	0	0
	72	11	90	1.4	0	1.5	0	0.5	0	0	0
	96	11	90	1.0	0	1.5	0	0.5	0	0	0
0.1	24	11	90	1.0	1.0	1.5	1.0	1.0	0.5	0	0
	48	11	90	0.5	0.5	1.0	0.5	0.5	0	0	0
	72	11	90	0.3	0	0.5	0	0.3	0	0	0
	96	11	90	0.3	0	0.3	0	0.3	0	0	0

us in a few cases of allergic subjects vaccinated with six scarifications through drops of B.C.G. at 60 mg. per c.c., of concomitant general reactions.

With 25 mg. as in groups of the "STRONG ALLERGY" category (Table IV), the local reactions are comparatively less intense, but the healing process is still delayed and occasional scar formation is observed, especially when pus is present. No hyperthermia or systemic reaction was noted in that group but the number studied is small.

With concentrations of 10 mg. and 5 mg. of B.C.G., as tested in groups of the "STRONG ALLERGY" category (Table IV), the drying of the local reaction to B.C.G. is completed for all cases in 96 hours, no matter what sensitivity to tuberculin could be previously shown. The peripheral redness has also practically disappeared and the local reaction is quite limited. In the case of a positive reaction, the difference with the control scratch is most striking at 72 hours and a previously doubtful reaction can now be definitely classified as positive or negative.

With the concentration of 10 mg. per c.c., the local reactions, both at 24 and 72 hours, especially in the "WEAK ALLERGY" and "INFRATUBERCULIN ALLERGY" categories of individuals (Tables V and VI), present mean measures slightly more important and offer a better early reading than with the concentration of 5 mg. per c.c.

With concentrations of 1 mg. and 0.1 mg. of B.C.G., the difference between a positive B.C.G. scarification test and the reaction to the control scratch is still appreciable, but the mean diameters, especially in subjects of the "WEAK ALLERGY" and "INFRATUBERCULIN ALLERGY" categories (Table V), are small and do not favour such an easy comparison and a practical early reading.

The optimum delay for an early and presumptive reading of the local reactions, as said above and as shown in Tables IV, V, and VI, would seem to be 24 hours, since, in most instances, the maximum of peripheral redness and œdema is then present. Doubtful reactions or those measuring 2 mm. or less, could be classified as positive or negative when read again at 72 hours. A negative reaction at that time will show at most a mere line or a trace of the scratch without inflammation.

In the group tested with 10, 5, 1 and 0.1 mg., a study of the *rectal temperature* immediately before and 24, 48, 72 and 96 hours after the tests with live B.C.G. vaccine has shown in all, *with no exception*, normal variations as compared with controls not B.C.G.-tested.

4. *Live or killed B.C.G.*

As to the difference in activity between live and killed B.C.G., our investigations, based only on a small number of cases (children and adolescents) would show that reactions to live B.C.G. are slightly more intense and more persistent. With a 10-mg. dose, live B.C.G. gave an average reaction of 1.6 mm. against 1.2 mm. for the killed vaccine. Thomassen (17), using the puncture method in adults, has obtained more striking differences, but he does not mention whether his subjects were previously tuberculin-sensitive.

Comments and Conclusions

The B.C.G. scarification test is more sensitive than all tuberculin skin tests: this total antigen detects the total tuberculous skin allergy. It is remarkably practical since no special instrument is required and, with the proper dosage, no complication is to be expected; the reading, at first sight, or with measurement, is very easy; doubtful reactions are practically eliminated; differences in size are small but obvious, the skin reactions, although very superficial, being strikingly apparent. When using the proper technique and concentration, which should not be less than 10 mg. per c.c. and not more than 25 mg., of live or dead B.C.G., scar formation can be avoided or reduced to a minimum.

We do not at present advise the mass application of this method, but it could be used for three very definite purposes:

1. To detect in certain clinical cases tuberculous infection in its infratuberculin allergic stage.

2. To give the epidemiologist, during special investigations, a more precise reference as to the diffusion of the tubercle bacillus.

3. To replace long, serial and costly tuberculin tests in view of the B.C.G. vaccination.

Are those subjects showing weak allergy or infratuberculin allergy to be vaccinated? We have vaccinated immediately with B.C.G. (6 scarifications of 1 cm.) all those showing a reaction of 2 mm. or less to the B.C.G. test after 24 hours, because their low degree of allergy would seemingly correspond with a poor degree of bacillary impregnation. Therefore, an artificial vaccination was deemed justifiable. In fact, no unwanted reaction was noted among the vaccinated subjects.

However, since the live B.C.G. test could also act as a booster dose, bringing faded tuberculin allergy to positivity or higher intensity and reinforcing resistance, we wonder if, *with this test*, a sufficient dose of B.C.G. would not be introduced so as to constitute, in the above-mentioned individuals, an efficient vaccination.

Summary

1. The authors describe and propose a new and practical skin test, introducing B.C.G. by scarification, in order to detect the total tuberculous allergy; that is, allergy to tuberculin as well as allergy to bacillary proteins, or bodies, infratuberculin allergy as well as tuberculin allergy.

2. Of 626 individuals found negative to a strong dose of tuberculin (0.005 mg. P.P.D.), 22.9 per cent were still positive to the B.C.G. scarification test, showing infratuberculin allergy, i.e. an accelerated reaction to B.C.G. and the Willis phenomenon (reduction of the pre-allergic period and enhancement of the reactivity to tuberculin). Similar findings were reported by few authors using intradermal or puncture tests.

3. It was found that the optimum live B.C.G. concentration for the test—that is, the concentration strong enough to show a reaction in the least sensitive individuals, including those infratuberculin allergic, but still unable to induce scar-forming reactions among strongly allergic subjects—is not less than 10 mg. per c.c. and not more than 25 mg. per c.c., preferably less.

4. The B.C.G. scarification test could be used for the following definite purposes: detection of infratuberculin allergy, epidemiological surveys of the distribution of tuberculous infection, and as an economical and efficient substitute for tuberculin tests in view of an immediate B.C.G. vaccination.

BIBLIOGRAPHY

1. Boquet, A., and Negre, L.: Ann. Inst. Past., 1926, *40*, 11.
2. Gomez, F.: Rev. de la Tuberc., 1930, *11*, 305.
3. Radossavlievitch et al.: Ann. Inst. Past., 1931, *46*, 188.
4. Coulaud, E.: Bull. Acad. Méd., 1931, *105*, 703.
5. Coulaud, E., and Lescuyer, G.: Rev. de la Tuberc., 1939, *5*, 1234.
6. Coulaud, E.: Rev. de la Tuberc., 1944, *9*, 241.
7. Corre, L.: Ann. Inst. Past., 1947, *72*, 441.
8. Gernez-Rieux, G., Breton, Houcke, Mereau and Sevin: Rev. de la Tuberc., 1947, *11*, 727.
9. Arnaud, J., and Chevalier, P.: Bull. et Mém. de la Soc. Méd. de Passy, 1943, *19*, 72.
10. Carlinfanti, E.: Policlinico (Sezione Medica), 1937, anno XLIV.
11. Chaussinand, R.: Far Eastern Assoc. Trop. Med., 1938, *2*, 567.
12. Chaussinand, R.: Bull. Acad. Méd., 1939, *121*, 669.
13. Chaussinand, R.: Rev. de la Tuberc., 1939-1940, *5*, 916.
14. Thorkildsen, R.: Nor. Med., 1942, *15*, 2579.
15. Romer, R. H.: Beitr. Klin. Tub., 1908, *XI*, 79; 1909, *XIII*, 1.
16. Calmette, A., and Guerin, C.: Ann. Inst. Past., 1908, *22*, 689.
17. Thomassen, O. K.: Acta Tuberc. Scand., 1947, *21* (1/3), 87.
18. Willis, H. S.: Am. Rev. Tuberc., 1928, *17*, 240.
19. Baldwin, E. R., and Gardner, L. U.: Am. Rev. Tuberc., 1921, *5*, 429.
20. Weill-Halle, B., and Saye, L.: Bull. Acad. Méd., 1937, *118*, 228.
21. Assis, A. de: O Hospital, August and December 1942; October and December 1943.
22. Canetti, G.: L'Allergie tuberculeuse chez l'homme, Flammarion, Paris, 1946.
23. Ellison, R. T.: Am. Rev. Tub., 1948, *58*, 463.
24. Chaussinand, R.: Ann. Inst. Past., 1947, *73*, 811.
25. Brinchmann, A.: Acta Paed., 1935, *17*, Suppl. 1.
26. Solem, J.: Acta Med. Scand., 1942, *141*, 435.
27. Rinvik, R.: Acta Paed., 1944, *32*, Suppl. 1.
28. Civeira, F. and Urioste, R.: Medicina (Madrid), 1946, *14*, 175.
29. Assis, A. de: as cited by Bueno, M.M.: Am. Rev. Tuberc., 1947, *55*, 259.
30. Bueno, M. M.: Am. Rev. Tuberc., 1947, *55*, 259.
31. Rosemberg, J.: Rev. Bras. de Tuberc., 1946, *15*, 327.
32. Andenoes, O. M.: Acta. Tub. Scand. 1945, *XIX*, 211.
33. Ustvedt, H. J. and Aanonsen, A.: Tidsskrift for Den Norske Loegeforening, 1948, *68*, 69; Acta Tuberc. Scand., 1949, *XXIII*, fasc. 1, 1.

THIRTEENTH ANNUAL REPORT OF THE COMMITTEE ON CERTIFICATION OF CAUSES OF DEATH, CANADIAN PUBLIC HEALTH ASSOCIATION

DURING the past three years, as a result of certain international developments in the field of vital statistics, attention has been directed to many of the problems upon which this Committee was focusing attention in Canada some ten years ago. These include:

(*a*) The essential lack of international or national secular comparability in cause-of-death statistics.

(*b*) The need for a uniform medical certificate of cause of death.

(*c*) The importance of paying more attention to the certifying physician's preference as expressed on the death certificate in selecting a cause of death for tabulation.

(*d*) The clinical absurdity of many current joint-cause selection practices.

(*e*) The limitations of duration, as recorded on the medical certificate of death, as a determining factor in the selection of a cause of death for tabulation.

(*f*) The desirability of keeping all doctors fully informed about the proper use of the medical certificate of death and the procedures employed in selecting causes of death for tabulation.

(*g*) The need for studies of medical certification practices.

(*h*) The importance of constantly re-directing the attention of all concerned to the fundamental objectives in the preparation of mortality statistics.

Recent Developments in the International Field

The Committee notes that the current phases of international development in vital statistics—particularly as they are related to cause-of-death practices—carry the international program for the first time beyond agreement on a uniform classification or list of causes, to agreement on:

(*a*) The use of a common international form of medical certificate of death.

(*b*) The principle that responsibility for indicating the train of events leading to death should be placed on the physician signing the medical certificate of death in the conviction that the certifying medical practitioner is in a better position than anyone else "to decide which of the morbid conditions led directly to death and to state the antecedent conditions, if any, which gave rise to this cause."

(*c*) The desirability of ensuring "protection of the confidential nature of the medical information contained in the medical certificate of death."

(*d*) The adoption of "the underlying cause" as the main cause for tabulation.

(*e*) The method by which the underlying cause shall be selected from the information recorded on the medical certificate.

Action by the Vital Statistics Council for Canada

At its meeting in October, 1948, the Vital Statistics Council for Canada adopted a resolution recommending in substance that this Committee be asked to review the proposed joint cause selection procedures and the application of supplementary rules where the general rule does not apply. A further resolution recommended that this Committee also be asked to review the Vital Statistics Handbook as published in 1946 and offer suggestions concerning the section on Registration of Death, pages 18 to 56.

These two resolutions were referred to this Committee in April, 1949, along with the following material:

(*a*) Regulation No. 1 of the World Health Organization.
(*b*) United States Vital Statistics Instruction Manual, Part 11.
(*c*) Volume 1 of the new Manual of The International Statistical Classification of Diseases, Injuries, and Causes of Death.
(*d*) Vital Statistics Handbook, containing the International List of Causes of Death.
(*e*) Excerpts from a "training deck" of examples of actual medical certification.
(*f*) Supplementary coding instructions tentatively suggested by the Dominion Bureau of Statistics.

Copies of this material were sent to each member of the Committee. Two meetings were held and many comments were secured by correspondence.

Cause-of-Death Selection Practice

Mindful of the fact that, under the new plan, selection of a cause for tabulation by rule was to be replaced by a selection based on the certifying physician's preference as indicated on the certificate, the Committee studied carefully the general rules for classification which are included in Volume 1 of the Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death. The rules employed by the General Register Office over the past ten years or more were examined. The contents of the Vital Statistics Instruction Manual, Part 11, prepared by the National Office of Vital Statistics, Washington, were also reviewed.

The Committee is in agreement with the general rule that the "physician's statement of the cause of death be accepted unless the information given is internally inconsistent or incomplete, in which case the general and supporting rules are to be applied and query made for additional information." Furthermore, the Committee considers that, in principle, further rules should not be elaborated to meet specific situations because such action would vitiate the entire system.

Tentative Supplementary Coding Instructions

The Dominion Bureau of Statistics referred to the Committee for comment a few supplementary coding instructions tentatively drafted for internal use. These were studied by the Committee and the full detail of comment which was considered in the tentative report presented to the Section meeting in June, 1949, was

sent to the Bureau for information. Comments on some of the larger questions follow.

Acute vs. Chronic

One of the more troublesome problems in assignment has always been to know what constitutes a "chronic" condition. The Committee feels that it is acceptable to make assignment to "acute", "chronic", or "unspecified" categories according to the medical record alone, independent of any stated duration. The matter of recorded duration was discussed at some length in its Third Annual Report of 1936.*

Surgical Operations

It is general practice to assign deaths following an operation to the disease for which the operation is performed. Where no related condition appears in Part 1 of the transcript, however, the certifier's preference should be accepted and the certificate queried, if necessary. A trial on this basis at least, is recommended.

Malignant Tumours

The increased interest in and use of published mortality data from cancer call for greater care in recording and tabulation. Of particular concern perhaps are the figures on cancer of uterus, lung and bone. In the case of cancer of the uterus, physicians should be encouraged to specify cervix or body of uterus—otherwise the available mortality data on cancer of the cervix uteri will continue to understate the facts. If it is at all possible, certificates which do not specify cervix or body of uterus should be queried. Cancers of lung and bone are so often metastatic sites of cancer that it is advisable to have the word "primary" used in all cases to be so tabulated. Here, too, the Committee is favourable to query before assignment.

Cardiovascular Diseases

Where endocarditis and myocarditis are both stated in Part 1 of the certificate; when acute bacterial endocarditis is shown with another heart condition; when arteriosclerotic heart disease is jointly stated with other heart conditions, including coronary disease and angina pectoris, assignment should be made according to the general WHO rules.

Diabetes Mellitus

The new procedure in selection of the cause of death for tabulation will affect several of the causes which have enjoyed sharp preferences. Diabetes mellitus is one of these. The Committee feels that the new statistics will more closely reflect the facts. Transcripts containing mention of diabetes should be queried when there are internal inconsistencies. There is no reason, however, to query a certificate containing diabetes as underlying cause if the doctor's opinion is clearly stated, even though there is no recorded evidence that the diabetes was uncontrolled.

*Canad. Pub. Health J., 1936, *27*: 404.

Maternal Deaths

Coding of maternal deaths should be based on the recorded facts. An arbitrary definition of the period over which a puerperal condition will be preferred to any other should be avoided.

The age span for diseases of pregnancy and the puerperium should be left at 10-60 years.

Congenital Malformations

All tumours, whether benign, unspecified, or malignant, should be assigned on the basis of recorded statements. Cases under one year should not be assigned to congenital malformations unless so specified.

Medical certificates of persons under one year of age, containing the terms myocardial failure or insufficiency, myocarditis, pulmonary insufficiency, should not be assigned routinely to congenital heart disease unless so specified. Assignment should be governed by the general rule.

Doubtful Diagnoses

The Committee considers that it is undesirable to set up arbitrary rules to cover interpretation of doubtful diagnoses which call for assignment to residual or ill-defined categories. Such rules would be in conflict with WHO rules 3a and 3f and with the entire spirit of the new system.

Deaths due to Violence

The Committee feels that the N code will provide data of wide usefulness and recommends that the nature of injury be coded routinely as the contributory cause in every death assigned to accidental causes.

Comments on the Training Deck

The Committee feels that the idea of developing a "training deck" is a good one. It should facilitate the promotion of uniformity as long as it is limited to the main general and ancillary rules. It should not be allowed to form the base for any arbitrary decisions. It is suggested that any training deck should show coding of contributory causes in all cases where there are any. Also, durations should be more regularly included.

Comments have been made by the Committee regarding each of the sixty-two examples which were supplied for study and these have been referred in detail to the Dominion Bureau of Statistics.

The Vital Statistics Handbook

The Committee feels that the Vital Statistics Handbook serves a useful purpose but that its objective should be more clearly set out in the preface by making reference to the desirability of keeping all doctors fully informed about the proper use of the medical certificate of death and the procedure employed in selecting causes of death for tabulation.

The Committee suggests that it may be worth while to review the need for both a Pocket Reference and a Handbook. The average doctor completes few death certificates each year and he just doesn't carry it about. The Committee

suggests that the functions of the two publications be combined much as is done in the United States. This essentially involves including in the present Handbook a list of key terms and some directions about unsuitable terms.*

The note on "the medical practitioner's statement of cause of death" (pages 20-21) requires little modification except for a more terse statement about cause of death for statistical purposes and relevant adjustments re the wording of the new international medical certificate of death. It will be important to note that only very *slight* changes had to be made in the Canadian certificate to bring it into line with the international form.

Although never included in previous editions of the Handbook, some reference should be made to the procedure which is followed in the selection of causes of death for statistical purposes. It is suggested that mention be made of the fact that, along with adoption of the new form of medical certificate of cause of death, there has been a fundamental change in the method of selecting the underlying cause of death for statistical tabulations. Whereas formerly the selection was based on arbitrary inflexible rules, selection is now based on the sequence of conditions recorded on the form by the physician, with only the merest framework of rules to facilitate assignment in the event that the certificate is incorrectly used.

It should be indicated in the revised text that it is essential under the new procedure for the physician to indicate clearly the train of events leading to death by proper placing of entries on the form—for on this, henceforth, will depend the extent to which published cause-of-death statistics reflect the clinical facts. Brief reference should be made to the requirement of a statement of "duration" on the medical certificate.

It is recommended that some broad reference be made to the substance of the general rules of selection agreed upon for use in making cause-of-death assignments where two or more causes are stated. In this connection, reference should be made to the policy of querying certificates wherever the expressed opinion of the certifying medical practitioner is not clear.

In order to emphasize the proper procedure in certification, it is suggested that consideration might be given to supplementing the examples on page 26 with illustrations of the common errors in certification.

The section of the Handbook dealing with the "International List" (pages 22-26) should be revised in its historical aspects simply to include the developments leading to the new International Statistical Classification of Diseases, Injuries, and Causes of Death, the new medical certificate of death, and the new cause-of-death selection procedure.

It is suggested that pages 27-55 inclusive, which are now devoted to the presentation of the detailed list of the 1938 revision, be replaced by comparable material relating to the new International Statistical Classification, including the full three-digit category list with both N and E codes.

Appropriate revisions are recommended in the stillbirth section (pages 57-58). A sample completed medical certificate of stillbirth would be a useful

**Mr. J. D. B. Scott records the strong conviction that the Physician's Pocket Reference and the Vital Statistics Handbook should be published separately. The Vital Statistics Council for Canada has endorsed the principle of separate publications.*

addition. It is recommended also that a definition of livebirth for statistical purposes be included. In addition, the practice in the assignment of infants reported as less than 28 weeks' gestation and who lived only a short time after birth might be mentioned.

Education and Training

The Committee recommends that the Dominion Bureau of Statistics make provision for the conduct of a series of classes for senior coders in health and vital statistcs departments throughout Canada. Such classes might be extended over a period of one week.

Doctors on the average sign very few medical certificates of death each year. Therefore, a selective approach in medical education is suggested, with a basic minimum for all plus a concentrated drive on hospitals (all types) and coroners, and with special attention to be directed to internes.

The Committee still feels that some specific undergraduate training in medical certification of causes of death is useful but alone it is not enough. As an introduction, possibly one half-day will suffice. In this connection, consideration is being given to revision of the exercise for medical students developed ten years ago and widely used.

The Committee notes that there has been little popular publicity on medical certification since the articles on the use of the new certificate were published in 1935-37. It is felt that it is opportune now for fresh papers on the use of the medical certificate of death, and on the International Statistical Classification, to be presented to the medical profession.

Some Important Principles for Guidance

Reviewing the whole field at this time, the Committee takes this opportunity to record a few salient observations for the future.

(*a*) *Rules*—In accordance with the stated objective and basic principles underlying the new procedure for selecting the cause of death for tabulation, all detailed rules of selection should be avoided and only the barest framework of rules which the extended experience of the British Register Office has shown to be necessary, should be retained.

(*b*) *Querying of Certificates*—All doubtful cases should be queried for guidance, and dependence placed on special rules of selection only where there is no alternative. This means that the number of certificates to be qeried over the next few years may sharply increase. This is unavoidable.

(*c*) *Medical Collaboration*—The new statistical system calls for closer medical collaboration and direction in the statistical offices throughout the country, such as is secured under the Quebec system of collecting vital statistics. There is no doubt in the view of the Committee that the new system will be difficult for a time to all responsible for the detailed work of assignment and medical collaboration will be important. The best illustration of this is the judgment required in the application of the exceptions to the general rule. Such discretion can only come with training and practice.

(*d*) *Duration*—The Committee has noted the decision to include on the new international medical certificate of death the "approximate interval between onset and death". The Committee wishes to direct attention again to its submission in 1936-38,* to the effect that duration be not asked for on the medical certificate at all. The Committee feels that this matter is worthy of further consideration, and urges that the value of and the need for including "duration" on the medical certificate of death be studied further, having in mind the possibility of dispensing with it.

(*e*) *Effect of the New Coding Plan*—The new plan is going to cause some changes in recorded mortality, especially in such diseases as pernicious anaemia and diabetes, and also probably cancer. Advance notice of the important changes to be expected in the official data for 1950 should be released to the consumers of vital statistics as soon as possible, based on studies made of the 1949 certificates. Appropriate action by the Dominion Bureau of Statistics is recommended.

(*f*) *Multiple Cause Tabulations*—The Committee reaffirms the view taken in its earlier reports that multiple cause tabulations are of limited value and need not be undertaken routinely. By the same token, except in the accident group where both N and E coding are desirable, only one cause need be coded and tabulated routinely. Multiple-cause coding and tabulation should be placed on a quinquennial or decennial basis only.

Special Action by the World Health Assembly

The Committee notes with interest two particular developments. The first is agreement on the establishment by the World Health Assembly of an Expert Committee on Health Statistics to be entrusted with the study of problems in the field of health including vital records and statistics. The second is the decision that special studies be undertaken by national committees in certain specified fields including confidential medical certification of death, adaptation of the International Statistical Classification of Diseases, Injuries, and Causes of Death to the needs of the armed forces, linking health statistics with other statistics, presentation of statistics on multiple causes of death, cancer registers and statistics, causes of foetal death, and tropical diseases.

In the suggested assignments Canada has been mentioned in two—adaptation of the International Statistical Classification to the needs of the armed forces, and methods of linking together health statistics with other types of related statistics.

Continuing Research and Study

In keeping with the several proposals contained in the eleventh and twelfth reports, the Committee believes that further investigation and study of the accuracy of medical certification and certification practices are warranted. Studies of the sort in mind would extend the observations made in the third and fourth annual reports of the Committee, provide a more effective base for any approach

*Canad. Pub. Health J., 1936, *27*: 304.

to the medical profession on the subject, and supply useful data on the reliability of the tabulated data.

The Committee recommends:

(1) That attention continue to be focused on the fundamental objective of the proposed new vital statistical practice so that sight will not be lost of the basic needs.

(2) That consideration be given to making such modifications in the type-setting and printing of any new medical certificates of death as will serve to direct the attention of the physician to the salient points in the use of the new form.

(3) That continued efforts be made to keep all doctors fully informed about the proper use of the medical certificate of death and the procedures employed in selecting a cause of death for tabulation.

(4) That further research in this field be continued and the findings of a dual coding study of 1949 data be released by the Dominion Bureau of Statistics for study as soon as possible.

(5) That, while the general principle and content of the International Medical Certificate of Cause of Death as recommended by the World Health Organization (which does not differ essentially from the Form used in Canada since 1935) is approved, the accuracy of the information which will be entered on the certificate for "interval between onset and death" and the usefulness of this information in selecting with any greater reliability the underlying cause of death, be made the subject of continuing review and study.

(6) That the Dominion Bureau of Statistics be asked to consider the desirability of setting up comprehensive courses of instruction for senior coding personnel in health departments throughout Canada.

Respectfully submitted,

A. HARDISTY SELLERS, M.D., D.P.H., *Chairman;*
MR. T. E. ASHTON, DR. M. R. BOW, MISS W. O'BRIEN,
DR. R. J. GIBBONS, DR. G. E. HOBBS, DR. C. W.
MACMILLAN, DR. PAUL PARROT, MR. J. D. B. SCOTT,
DR. C. B. STEWART.

November 18, 1949

Canadian Journal of Public Health

EDITORIAL BOARD

R. D. DEFRIES, M.D., D.P.H., *Editor*
N. E. MCKINNON, M.B., AND J. T. PHAIR, M.B., D.P.H., *Associate Editors*
R. L. RANDALL, *Assistant Editor*

J. H. BAILLIE, M.D., D.P.H. GORDON BATES, M.D. A. E. BERRY, M.A.SC., C.E., PH.D. J. G. CUNNINGHAM, B.A., M.B., D.P.H. C. E. DOLMAN, M.B., B.S., PH.D., D.P.H., M.R.C.P. D. T. FRASER, M.C., B.A., M.B., D.P.H., F.R.S.C. EDNA L. MOORE, REG.N. E. W. MCHENRY, M.A., PH.D. G. D. PORTER, M.B. A. H. SELLERS, B.A., M.D., D.P.H. A. W. THOMPSON, C.S.I.(C.). F. O. WISHART, M.A., M.D., D.P.H. J. WYLLIE, M.A., M.D., CH.B., B.SC., D.P.H.

THE COXSACKIE VIRUS: RELATIONSHIP TO POLIOMYELITIS

IT is well recognized by workers in North America that several viruses produce clinical manifestations simulating those of poliomyelitis, and accordingly in research work it is necessary to carry out somewhat elaborate laboratory investigations to verify a clinical diagnosis. Recently this situation has been further complicated by the reports of Dr. Gilbert Dalldorf, Director of the New York State Laboratories, Albany, and his associates, that yet another virus infection has to be considered in differential diagnosis (1, 2). This new virus was first isolated from patients in the village of Coxsackie in New York State in 1947. In this year workers in various parts of North America reported that mild attacks of what was accepted at the time as non-paralytic poliomyelitis were unduly prevalent in relation to the number of frankly paralyzed cases. Sabin in Cincinnati (3) and Rhodes in Toronto (4) were able to recover only comparatively few strains of poliomyelitis virus from such mild illnesses. In retrospect, it appears possible that some of these suspected poliomyelitis cases may have been examples of infection with the Coxsackie virus. Melnick and his co-workers in Dr. John Paul's department at Yale University at New Haven, Connecticut, have played a notable part in the investigation of this new disease (5, 6), and have reported isolations of virus from Ohio, North Carolina, Texas, Rhode Island, and Connecticut. Jaworski and West describe the clinical features of some of these cases (7).

It appears that there are a number of antigenic types of the Coxsackie virus, and that the phrase "Coxsackie group of viruses" should be used. The main biological characteristic of the virus is pathogenicity for suckling mice and hamsters, older animals of these species as well as monkeys and other animals being insusceptible. These properties are in sharp distinction to those of human poliomyelitis virus of the rodent (Lansing) or monkey pathogenic types. The apparent primary lesion in suckling mice is in the skeletal muscles, where there is marked involvement of striated fibres, with swelling, hyaline or waxy change, and loss of transverse striation. In some areas the fibres disappear completely. There is

marked proliferation of the cells of the sarcolemmal sheath, but no frank inflammatory exudate.

The Coxsackie virus has been isolated from the stools and nasopharyngeal secretions of patients with illnesses characterized by "meningeal" irritation diagnosed as non-paralytic poliomyelitis or aseptic meningitis. It has also been recovered from short febrile conditions, and can evidently cause a muscular weakness. Laboratory infections have occurred (5,6). Antibody develops in convalescence, but titration of antibody level presents technical difficulties.

With regard to the association of this new virus with that of poliomyelitis, Melnick referred to the recovery of both agents from pooled faecal specimens and flies (5). Very recently, working in Toronto, Silverthorne, Rhodes, and their associates at the Hospital for Sick Children and the Connaught Medical Research Laboratories reported the isolation of both the Coxsackie and human poliomyelitis viruses from the separately collected stools of 3 children, contacts one of another (8). These workers also refer to the isolation of the Coxsackie virus from three adults, in contact with the children mentioned, and from another child, in whom the clinical diagnosis was Guillain-Barré-Landry ascending paralysis.

It is evident therefore that infections associated with the Coxsackie group of viruses are widespread in North America. The reported association of human poliomyelitis virus and Coxsackie virus in individual patients raises interesting questions. For example, is it possible that infection immunizes against the other, or that one virus exerts an interfering or blocking effect on the other? It remains to be seen, however, whether this association of the two agents is commonly observed; certainly it is far from universal.

It would appear that an interesting chapter is now being unfolded, and it may be that several problems in the aetiology, pathogenesis, and epidemiology of "poliomyelitis" will before long be answered. There is more justification than ever before for insisting that a diagnosis of poliomyelitis, especially the minor illness (abortive) or non-paralytic (meningeal) varieties, can only be tentative until confirmed by laboratory tests. Reports from laboratories in Britain and other parts of the world on this question are awaited with interest.

REFERENCES

1. Science, 1948, *108:* 61.
2. J. Exper. Med., 1949, *89:* 567.
3. Am. J. Hyg., 1949, *49:* 176.
4. Canad. M. A. J., 1949, *60:* 359.
5. Proc. Soc. Exper. Biol. Med., 1949, *71:* 344.
6. J. A. M. A., 1949, *141:* 894.
7. J. A. M. A., 1949, *141:* 902.
8. Canad. J. Pub. Health, 1950, *41:* 51.

A VACCINATION HINT IN INFANT AND SCHOOL CLINICS

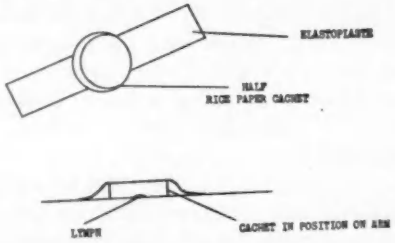
IN school and well-baby clinics where a number of vaccinations are performed the following procedure is found to be most satisfactory.

The infant or child is vaccinated in the orthodox manner by either a short scratch about 1/8′ long or by the puncture method.

The fact that the lymph has to dry on the arm before the sleeve is pulled down again necessitates the mother's sitting around holding the clothing off the vaccination area. This is rather irritating for child and mother alike.

The vaccination should not be covered with a dressing. Once the papule and vesicle starts forming, the drier it is kept the less chance there is of an unpleasant manifestation.

In this Health Unit the initial scratch or puncture through the wet lymph is covered immediately with one half of a rice paper cachet. The outer surface of a half rice paper cachet is placed in the middle of a piece of elastoplaste or zinc oxide adhesive plaster ½″ wide and 2½″ long. This "dressing" is prepared before the skin area is cleansed for the vaccination. As soon as the vaccination has been performed, the cachet "dressing" is applied over the wet lymph. The sleeve or clothing can then immediately be pulled down. The waiting



time for drying of the lymph is thus completely eliminated. The mother is instructed to remove the cachet that evening. This procedure reduces the percentage of failures due to inadequately dried lymph being rubbed off on to the clothing and provides protection necessary to ensure inoculation of the virus into the dermis.

LESLIE C. ALLAN, M.B., CH. B., D.P.H.
Director, Rosebud Health Unit
Didsbury, Alberta

A NEW APPROACH TO BABY RECORDS IN RURAL HEALTH UNITS

ONE of the main functions in a rural health unit in Alberta is to organize and maintain interest in the well-baby clinic. In a rural area these clinics are held once a month in the smaller towns, villages and settlement centres throughout the district. The objects of such a clinic are to provide advice to mothers on the normal growth and development of the child. The mother is encouraged to attend the clinic regularly for the first five years of the child's life and to accept the schedule of protective inoculations performed for the prevention of certain communicable diseases. The health-clinic staff must never find any question too trivial for a sound, practical answer, and must always be on the alert to correct faults detected or suspected in the young baby.

Usually at the infant's first attendance at such a clinic the printed baby record card is made out. The salient points of the baby's visit to the clinic are recorded, and the mother is given the advice she sought, along perhaps with suitable health literature. This

highly impersonal record card is then carefully refiled according to the system used, and there it usually remains until required at the next visit. In some clinics a small card is given to the mother to keep, and on it is recorded the weight of the child on the date of examination, together with an entry under the "remarks" column.

These record cards no doubt adequately serve their purpose. It was felt, however, that regular attendance at the baby clinics could be further stimulated by providing the mother with an attractive baby record booklet which would show in graphic form the child's progress. The book was designed with the end in view that both the mother and the clinic staff would have to fill in appropriate sections in order to make it complete. In this way a much more personal and intimate feeling has been introduced in these baby clinics.

On first attendance with the baby at a clinic the mother is given the record booklet, which is entitled "My Baby's Progress." The booklet was produced with outer covers of blue cardboard for boys, and pink for girls, the conventional nursery colours. Attractive baby figures appear at the top of most of the pages. On the outer cover the particulars relevant to name, parents' names, birthday and clinic centre are entered.

On the inside page there is space for entering details relating to breast or artificial feeding, with recommended formulae. Below this is a graph for entering the baby's weight at convenient intervals. A red tracer line showing an average weight gain for a 7-pound baby runs across the graph. It is emphasized that each baby is an individual, and every weight plotted will not fall on this line. So long as the gain in weight is following the general pattern of the curve, satisfactory progress is being maintained.

Part of the next page is devoted to details of a physical examination to be completed by the doctor. It is under broad headings and can be completed in simple language.

A further section emphasizes the importance of giving the supplementary vitamins A, D and C. The suggested forms of these vitamins are printed and a suitable dose for individual needs can be filled in by the clinic staff.

In order to encourage the parents to have a personal interest in the book, the next section is to be filled in by them. It relates to the mental and physical development of the baby during the first year. Milestones in development can be recorded for future interest in the spaces provided; i.e., first smile; held head up well; began to crawl; drank from cup.

On the next page is a graph for height and weight progress from first to sixth birthday. A red trace line appears across the graph showing the pattern for the average child during these years. An entry can be made on this graph when the child is brought back for periodic physical check-up or at times of reinoculations.

A section has been prepared detailing the inoculations given by the clinic, the number of doses required for each series, and the recommended time they should be given. The date on which the inoculation is given is filled in at each attendance. For clinic records a separate inoculation card is also made out and kept up to date with each attendance. This is transferred to the school record when the child commences school. The intervals between primary inoculation and reinforcing doses are also outlined under this heading.

Some further points of development during the first and second year are presented for parents to complete. Some examples in this section are: walked alone, began to feed self, and first said "I won't."

The order and time of appearance of the primary teeth is a point of interest to all mothers. To help them identify the teeth, a skeleton outline of the upper and lower jar is printed and each tooth numbered. Reference to the key names the tooth, and outlines the usual time of appearance. Below is a numbered outline for re-

cording the actual age at which each tooth appeared.

In the final section, which lists the common infectious diseases, parents cen enter the month and year in which the child suffered an attack of any one of these conditions. It is well to know this for school record purposes. In addition, an entry can be made, under operation record, of the dates of a tonsillectomy or other operation during childhood.

This booklet is given to the mother and constitutes her baby's record. She is impressed with the need to bring this booklet at each visit to the clinic with the baby. The only record kept by the clinic is the inoculation card and an entry in the attendance register of each clinic visit. Mothers have responded well to this new system, and rarely forget to bring the record booklets with them. Once started, they are anxious to keep their record book up to date and realize that this responsibility rests with themselves.

These booklets should be available for reference when the child commences school. The information contained in them should be accurate and easily transferred to the school medical cards.

This new record system has now been in operation nearly nine months. The results so far indicate that the experiment has been well worth while, and that the system will be permanently adopted.

LESLIE C. ALLAN, M.B., CH. B., D.P.H.
Director, Rosebud Health Unit
Didsbury, Alberta

BOOKS

Mental Hygiene in Public Health.

By Paul V. Lemkau, M.D. McGraw-Hill Series in Health Science, Amos Christie, M.D., Consulting Editor. New York, Toronto, London: McGraw-Hill Book Company, Inc., 1949. 396 pp. $5.45.

DR. LEMKAU'S 400-PAGE VOLUME should be available to everyone interested in mental hygiene or public health. The worker in the public health field will find in this book psychiatric theory developed to logical common sense, rendering it readily applicable to every-day problems in the preventive field. The psychiatrist reading this work will receive two benefits: he not only will be given more understanding of the prevention of mental disorder but he will also see the available scientific data on the causation of mental disorders presented in a lucid, readable, well-organized fashion.

Public health has moved into the field of psychiatry to the point where mental disorder is considered a major public health problem. Heretofore psychiatry has been chiefly concerned with classification and therapy. Now it has been forced to recognize that the next important advance in the psychiatric field must lie in the realm of prevention. This volume provides a common ground which is an ideal meeting place for both the psychiatrist and the public health worker.

Dr. Lemkau is well qualified for the task which he has undertaken. He is Associate Professor of Public Health Administration and Director of Mental Hygiene Study in the School of Hygiene and Public Health in Johns Hopkins University. Starting out as a psychiatrist, he ventured into the field of public health and health education because he recognized the interdependency of these two disciplines. He possesses the breadth of view that is characteristic of men trained under the influence of Adolph Meyer, who was the leading exponent of the psychobiological approach. This point of view attempts to take into consideration all the influences, physical as well as psychological, which affect the individual. It does not restrict itself to either a narrow organic theory of causation on the one hand, nor does it embrace a too rigid doctrine of psychodynamics on the other. It attempts to place scientific observation above speculative theory.

In the first part of his book Dr. Lemkau tries to establish the community of interest between mental hygiene and public health. He attempts to show how the techniques which have been developed by each of these two disciplines can work together in the interest of the individual.

In the second part of the study he breaks into separate epochs the life picture of the individual which include preschool, school, occupational, etc., up to and including the period of old age. In each of these periods the particular stresses which are encountered are dealt with and the methods which may be used for prevention discussed in detail. The chapters on the adolescent period and old age seem particularly useful.

The best feature of this presentation is its clearness and readability. Coupled with this, one must comment on the logical discussion of points of views which are still controversial. The author modestly rejects any suggestion that either he or science has the final answer.

Dr. Lemkau avoids the stereotyped description of various clinical syndromes which marks the advent of so many psychiatrists to the field of authorship. He most nearly falls into this pitfall in his "review of psychopathological states" where he probably places undue emphasis on a classification which is generally admitted to be psychiatry's weakest point. In view of the fact that a classification, even though a poor one, would be of some assistance in orientating the relative newcomer to psychiatry, this insertion is probably defensible.

The bibliography is outstanding and is of value to both newcomers and experienced students in the field. It completes a work that is an extremely important contribution to both public health and mental hygiene.

D. G. McKerracher

Health Guides and Guards.

By Francis P. Wall and Louis D. Zeidberg. 4th ed. New York: Prentice-Hall, Inc., 1949. 390 pp.

THE FIRST EDITION of HEALTH GUIDES AND GUARDS was published in 1936. The purpose of the book is "to awaken the consciousness of the public to its own problems of hygiene." Practical material only is presented, and details have been avoided that would fit in a course for students of public health. Nevertheless, an attempt has been made in this revised edition to include the current knowledge of newer agents of treatment.

Twenty-three chapters are devoted to personal hygiene. As the authors claim, "before one can appreciate the proper measures to employ in order to keep healthy, one must understand what constitutes a normal functioning of every integral part of that complex organism called the human body."

The genital system and the social diseases are considered in more detail than is accorded the other sections; in fact, nine chapters deal with the subject. Mention of a certain method of prevention renders the text objectionable to Catholics. Some considerations on various forms of treatment will probably go over the heads of lay readers and could have been omitted.

There is a lengthy chapter on first-aid, but none on the prevention of accidents.

The second part of the volume, comprising thirteen chapters, deals with community hygiene; six are concerned with communicable diseases and five with public sanitation. Those on contagious diseases are presented in a fashion which reminds us of the American Public Health Association's booklet on standards of control. In these chapters, and for each disease, after a brief sketch of symptoms, the subject matter is offered in a didactic and strictly uniform pattern: infective agent, source, portal of exit, transmission, portal of entry, incubation, communicability, control, prevention, and results.

The usual aspects of sanitation—water, milk, food, sewage and refuse—are covered. The value of pasteurization is described only in the brief statement that it accomplishes a partial sterilization of milk by heat. Some readers will wonder if the authors themselves are convinced of that, and many will certainly miss the point.

The text is illustrated with twelve diagrams and followed by twenty-six detachable questionnaires combining "yes and no" and essay questions. This is suitable for class work and intimates that the book could be used by teachers and perhaps by pupils as a reader. This naturally would depend on the conformity of the text with the health curriculum in certain grades of high school. It would probably be more suitable for the education of adult groups. A carefully prepared index will be found useful for quick reference to particular items.

In spite of minor weaknesses, which no doubt would pass unnoticed by lay readers, this is a valuable book that can be recommended to the public for general information on personal and community hygiene. Public health educators will find it easy to supplement this text either with considerations on local applications or with further explanations on points of general hygiene.

Jules Gilbert

Guide Posts to Mental Health.

New York State Department of Mental Hygiene, Albany, 1949.

EVERY ONCE in a while amongst the volume of material that comes to our desk from health agencies throughout the world, both voluntary and official, there appears something which we feel that people practising public health in the field should have at their finger tips—some material which we feel will make their job more interesting and effective. Recently, the New York State Department of Mental Hygiene issued a series of pamphlets entitled "Guide Posts to Mental Health". There are seven pamphlets, all attractively printed: Life Begins, School Days, Teen Time, Your Job, Your Marriage, The Middle Years, The Golden Age. These leaflets were designed for distribution at a special exhibit put on by the Department of Mental Hygiene at the New York State Fair. They present in readable, easily understood form the emotional needs of the individual throughout his life, and aim to promote a better understanding of mental hygiene principles in everyday situations.

Public health workers who are constantly searching for new material to distribute, may obtain the leaflets by addressing the State Department of Mental Hygiene, Governor Alfred E. Smith State Office Building, Albany 1, N.Y. There is no charge.

J. H. Baillie

How Shall We Pay for Health Care?

By Oscar R. Ewing and George F. Lull, M.D. Public Affairs Pamphlet No. 152. New York: Public Affairs Committee, Inc., 22 East 30th Street, 1949. 20c.

THE PUBLIC AFFAIRS COMMITTEE has prepared a statement by Oscar Ewing, Federal Security Administrator, outlining briefly and clearly the government's stand on health insurance, and a statement by Dr. George F. Lull, secretary of the American Medical Association, presenting the basis for the Association's opposition to compulsory health insurance. There is also included a final chapter by Martin Seifert, a free-lance journalist, on other health plans, in which he outlines briefly the four major pieces of legislation that have been introduced in Congress which vary from that introduced by the Federal Security Agency. He also outlines the viewpoint of the National Academy of Medicine and the Catholic Service Organization, and sums up with a note on the issues that are stake.

To all those public health workers who are interested in medical-care programs and health insurance, or their possible effect on the public health program, this pamphlet offers, in readily absorbable form, an outline of the problem as it exists in the United States. Such pamphlets should be very valuable to distribute to the members of a health officer's community who have taken a stand one way or the other in this current problem.

J. H. Baillie

Length of Life.

By Louis I. Dublin, Alfred J. Lotka, and Mortimer Spiegelman. Revised ed. New York: The Ronald Press Company, 1949. 379 pp. $7.00.

LENGTH OF LIFE has been a standard reference text on the life table and longevity since it was first published in 1935. This new edition is far more than a simple revision of the first edition. Every chapter has been completely rewritten, not simply by bringing the data up to date but by revising the text and method of presentation as well. The provision of chapter summaries is a useful addition.

Two new chapters have been added. Chapter 7, "Biological Factors Influencing Longevity and Mortality," includes antenatal and neonatal risks to the child, risks associated with pregnancy and childbirth, sex differences in general mortality, and mortality in relation to marital status. In Chapter 9, "Forecasts of Mortality and Longevity," methods of forecasting mortality rates for the purpose of population projection, and generation life tables are discussed. Chapter 15, "Life Table Construction", has been supplemented by the inclusion of an account of a method of abridged life table construction.

Length of Life provides a story and an interpretation of the recorded progress in health and longevity. It draws attention to some of the underlying factors which have been responsible for the great increases in the expectation of life which we now enjoy and presents a discussion of the influence of family history, mental status, body build, medical history and occupation.

The latest life-table material available for the United States, Canada, Europe and other countries as well, is included in the appendix. A complete list of source references is also provided.

While there may be some differences of opinion concerning a few of the statements made in the book, these are of minor order. The authors are to be commended for having accomplished so successfully the production of a book which has involved such prodigious effort.

Students of population problems and health statistics will find in this book a useful summary of the place of the life table in the measurement of population trends and a wealth of information on the factors contributing to longevity. For many years to come this book will be an invaluable reference work for all concerned with the health and welfare of mankind.

A. H. Sellers

The Invert and his Social Adjustment.

To which is added a SEQUAL. *By Anomaly, with an introduction by R. H. Thouless, N.A., Ph.D. Second edition, 1948. Baillière, Tindall and Cox, London, England; Macmillan Company of Canada Limited, Toronto. 289 pp. $1.65.*

THIS REVIEWER, like most medical men, knows that he knows little or nothing of homosexuality. He thus differs from the soothsayers who presume to know much and are thus a ready means of deception for themselves and others. He finds most, though not all, modern contributions on homosexuality in medical and related literature so tinged and

tained with psycho-analytical jargon and half-truths (the most deceptive of all) that he profits none by the reading of them. This little book is different.

It has been written by one who says he is himself a homosexual and has tried, for the bigger part of his life, to study the condition, to analyze its characteristics, its causes and its effects; and he has tried, too, to find a solution for it. He has found a solution for himseld. He does not suggest that it is the solution for others. He makes a plea that the medical profession, the clergy, the legal profession and others on whom the affliction touches might be somewhat better informed, and have a deeper sympathy through understanding. The book is well written, thought-provoking and informative. It reflects an anonymous author with a sensitive mind, keenly observant and analytical, a deep cultural background, an acquaintanceship with a broad life, and a facile pen; it is free from pseudo-scientific embellishments.

The author's hope is "that through the agency of charitable physicians, clergymen, or other advisers this book may find its way into the hands of many persons to whom it may be a source of comfort and encouragement." This book will give medical men a better understanding of homosexuality than they would get from most treatises on the subject.

N. E. McKinnon

Child Health Services and Pediatric Education.

Report of the Committee for the Study of Child Health Services, the American Academy of Pediatrics. New York: The Commonwealth Fund, 1949. 270 pp. $3.50.

THIS EXCELLENT and comprehensive survey was made in 1947 by the American Academy of Pediatrics in co-operation with the United States Public Health Service and the United States Children's Bureau. The survey was done in each state—a method which, though it produced some discrepancies in compilation on a national basis, was considered more useful for future action.

The economic status of states and regions, and the number and distribution of children are considered in the introductory chapter. For purposes of comparison, five regions are used—Northeast and Central, Mountain and Plains, Pacific, Southwest, and Southeast; and counties are grouped as greater metropolitan, lesser metropolitan, adjacent, isolated semi-rural, and isolated rural. It is notable that two-thirds of the counties fall into the isolated category.

Child health services are studied from the point of view of total volume of child health services, private practice, hospitals for children, and community health services. A major point brought out is that 75% of children are under the care of general practitioners and almost half of these had had little hospital training in pediatrics before entering practice.

As might be expected, the distribution of physicians and services is less favourable in isolated areas, and the amount of medical and dental care received varies with the per caput income. The economic factor is consistently evident in the differences in health facilities and services.

Hospital beds for children were found to vary from 18 or more per 1,000 children to under 9. In spite of the great increase in babies born in hospital, still half of the babies are born at home in isolated rural counties. A grading for quality of care in hospitals points out the deficiencies in isolated counties and in small hospitals and the wide variation from state to state.

Under Community Health Services, five types are considered in the comparative summary: well-child conferences, mental health services, clinics for the physically handicapped, public health home nursing, and dental clinics. This is the one place where there is not a close correlation with the pattern of economic status. The problem of distances apparently has a greater disadvantage in the middle West regarding these services.

Well-child conferences are considered "one of the outstanding advances in local public health organization," but they do not make up for the lack of health supervision by private practitioners in many states.

Undergraduate and graduate training in pediatrics is thoroughly studied. Emphasis is placed in the fact that the quality of service given will depend on the training and experience of the individual physician.

Wide variation is found in undergraduate pediatric courses. The time allotted varies from 141 hours to 478 hours, and similar discrepancies in teaching methods, type of staff, and clinical facilities are noted.

Inadequate budgets of the low-ranking pediatric departments are part of the problem.

Graduate education is considered in rela-

tion to hospitals accredited for residency training in pediatrics. Only 2 out of 5 graduates have any training in these hospitals. Inpatient and out-patient training, the amount of teaching received, and actual experience similar to private practice are compared in the 158 hospitals.

In the final analysis it is stated that "the present system of medical education is poorly adapted to train a physician for general practice so largely concerned with the care of children". Also, as health supervision accounts for one-third of the visits of children to general practitioners and one-half of the visits to pediatricians, "the teaching of normal growth and development or the preventive aspects of child care is obviously inadequate."

Thus the first need is considered to be for more physicians with better training in child care.

Isolated counties have the least health services and yet one-third of the total child population live in these counties. Only about one-third as many general practitioners for the same number of children are in these areas. Increased hospital facilities and well-trained physicians to staff them are essential to make a high quality of medical care available in rural areas.

Numerous charts, maps and tables illustrate the text, and are clearly presented.

Considering the similarity of conditions in the United States and Canada, much of this information is applicable in general. Mention is made of the fact that a similar study of Canadian medical schools and accredited hospitals has been undertaken. It is to be hoped that this valuable survey will be used for the purpose it is intended—the improvement of child health.

Ruth MacDougall

NEWS

British Columbia

DURING JANUARY the provincial department of Health and Welfare was visited by Dr. K. C. Yeo, Deputy Director of Health Services for the Medical Department of Hong Kong. Dr. Yeo is on a U.N.E.S.C.O. Fellowship, travelling through Canada studying the national as well as the provincial departmental organization. During his stay in Victoria Dr. Yeo spent time with the various divisional directors of the Department and visited one of the local health units. While here he also visited the Dominion Quarantine Station at William Head accompanied by Dr. R. B. Jenkins, medical officer in charge. Dr. Yeo concluded his visit by speaking to a meeting of the senior staff of the Department, on the various problems being faced by the Health Department of Hong Kong.

DR. J. A. TAYLOR, D.P.H., Director of the Bureau of Local Health Services and the Division of Health Units, has been appointed Deputy Provincial Health Officer. Dr. Taylor has carried the responsibilities of this position since March 1948, when Dr. J. S. Cull resigned to take up a position with the Red Cross Blood Donor Service. Dr. Taylor has been with the Department for twelve years, during which time he has served as medical health officer in the Fraser Valley Health Unit, Peace River Health Unit, North Okanagan Health Unit, and the Central Vancouver Island Health Unit. He accepted a transfer to a senior administrative position in 1948. Dr. Taylor will continue as Director of the Bureau of Local Health Services and Director of the Division of Health Units. His appointment as Deputy Provincial Health Officer was made retroactive to June 1949.

Saskatchewan

THE PROVISION of a statistical clerk for the North Battleford Health Region on January 1 has brought to four the number of health regions being served in this way. This has meant that registrations of births, deaths, and marriages are now being channelled to the regional medical health officers by the division registrars of 4 cities, 23 towns, 135 villages, and 126 rural municipalities or local improvement districts. The cities of Regina and Saskatoon have been receiving this information for many years, since their medical health officers are the division registrars. Consequently, at the

present time, 45 per cent of the birth registrations, 49 per cent of the death registrations, 41 per cent of the stillbirth registrations, and 47 per cent of the marriage registrations within the province are being made available for the use of the medical health officers in the planning of their public health programs.

A SERIES of Foodhandlers' Schools, sponsored by the Junior Chamber of Commerce, was held at two centres in the North Battleford Health Region during the second week in January. The schools were conducted by the regional staff from North Battleford and two members from the Division of Health Education, Regina.

Manitoba

DR. MARCEL LANGLOIS, Assistant Director of Health Insurance Studies in the Department of National Health and Welfare, spent three days in Manitoba early in January. He came here to inspect the diagnostic units at Dauphin and Selkirk and to confer with officials in the provincial Department of Health and Public Welfare.

DR. M. R. ELLIOTT, Director of Extension Health Services, represented Manitoba at the three-day conference in Ottawa of directors of provincial health surveys.

THE MANITOBA FOOD Technology Association was organized recently, with 38 members. The association meets monthly to hear scientific papers and hold discussions. The president is Dr. E. C. Chamberlayne, Director of Food Control for the provincial health department; the vice-president, A. L. Shewfelt of the Dominion experimental station at Morden; and the secretary, G. W. Andrich, plant chemist for Canada Packers Ltd. in St. Boniface, Manitoba.

G. PHILLIPS has been appointed sanitary inspector to the Winnipeg District Office, replacing A. E. Lunde who is now with the Stonewall Health Unit.

AN 8-BED MEDICAL nursing unit at Arborg, Manitoba, was opened in January. It is the first Red Cross Hospital in Manitoba and was financed by the local community, the Red Cross and the Manitoba Government.

THE MANITOBA SOCIETY for Crippled Children was recently formed with Mr. Justice A. M. Campbell as president. The directors are: P. C. Pratt, A. U. Chipman, Edmund Allen, H. M. Harris, A. M. Oswald, L. R. Corbett, Edmound Chown, Frank Billinkoff, J. M. Hanson, W. L. Morton, Ed. A. Wynne, H. M. Pickard, F. M. Burbidge, Gurney Evans, K. M. Mitchell, G. H. Ryan, Miss Esther Hines, Mrs. Gordon English and B. A. Robinson.

New Brunswick

THREE YEARS AGO AN extensive course of public health was charted in the postwar mapping of improved services for New Brunswick. Today that basic program has been completed and all the divisions or branches of the Department of Health planned have been set up and are in various degrees of operation. Next step will be expansion into the field work blue-printed for the newer departments.

Dr. R. R. Prosser, a widely experienced psychiatrist who went from his native Nova Scotia to Scotland in completing his education and to India and the British front in Burma and Malaya in his chosen work, has been appointed director of the latest division created—that of Mental Health. He took over his new duties in Fredericton in early January, coming to the province from the Nova Scotia Health Department. With establishment of the mental hygiene administration under Dr. Prosser, the last of the branches planned in 1946 became a reality.

Perhaps one of the greatest advances made by the Department under the Minister, the Hon. Dr. F. A. McGrand, and the Chief Medical Officer, Dr. J. A. Melanson, in the past year was the introduction of a program of health education—one of instruction in public health to teachers-in-training. Miss K. MacLaggan, Reg. N., highly qualified as public health nurse and school teacher, was appointed to the Teachers' College staff to direct this effort. The two departments—Health and Education—have joined in this project and a successful program has been launched that should go far to bring about a school health service. The public health nursing service has its part to play as well, and the nurses will serve as helper and consultant to the school teachers in their districts as the latter assume a good share of the responsibility for the health of pupils in their charge.